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ROTARY REGULATION.

The interesting paper read by Mr. Charles W. Stone before the American Institute of Electrical Engineers at its recent meeting, and which is published practically in full elsewhere in this issue, contains a novel suggestion for the regulation of the direct-current voltage of rotary converters. This method is attributed to Mr. J. E. Woodbridge and is very ingenious. It is also reported that it meets practical conditions excellently. The methods heretofore employed for accomplishing this purpose require auxiliary apparatus which react upon the line and change the potential at the alternating-current side of the rotary. While these methods accomplished, in a way, the end sought, they were not ideal, since auxiliary appliances were necessary; the regulation not being brought about in the rotary itself.

In the Woodbridge method the regulation is accomplished in the rotary, as advantage is taken of the change in the ratio of transformation which can be caused if the distribution of flux under the pole-pieces be changed. As is well known, the direct-current potential is equal to the maximum value of the alternating-current potential, while the effective potential on the alternating-current side is only the square root of the mean square value. If, then, the ratio between the maximum and the effective values on the alternating-current side can be changed, the ratio of transformation would likewise be changed, and in the same degree. If means are provided for changing the distribution of the flux under the rotary so that the maximum value of the alternating-current counter-electromotive force of the rotary will be changed, the ratio of transformation will likewise be changed. This is what Mr. Woodbridge accomplishes, his method being to cut the pole into three sections, placing different windings around them, and to control the excitation of the three sections.

The amount of regulation securable in this way is limited, and Mr. Stone does not give any figures to show how great it may be. Standard books on the design of rotaries say the ratio of transformation may vary as much as ten per cent, depending upon the distribution of flux, but probably a considerably greater range can be obtained if special provision be made to change the distribution. Another method of securing regulation was also mentioned by Mr. Stone in his paper, this being suggested by Mr. J. L. Burnham, whose plan is to cut the pole into two sections, on one of which is placed the main shunt winding, and on the other an auxiliary winding. The control of the transformation ratio is obtained by varying the excitation of the auxiliary section. Of course, any other method of

varying the flux distribution should produce similar effects. This might be secured more or less satisfactorily by some of the devices employed for varying the speed of shunt motors. It might be well worth while testing some of these methods in order to determine their suitability.

It would also be instructive to have some results of the proposed methods of regulation. There must be some effect upon the power-factor and losses, but Mr. Stone says the former is but little changed and as the losses are small anyhow, there can not be much change in them. The success of the plan, then, seems to rest entirely upon the degree of control obtained over the potential of the machine.

ELECTRIC PROPULSION ON CANALS.

Of the various plans proposed and tried for moving barges along canals by means of electric power, the storage battery has of late received scant consideration. This is probably due to the failure of the battery to compete with the trolley system in electric railway work, and hence we have had descriptions of various plans of hauling boats by tractors running on a towpath, some of these being more or less elaborate, depending upon the amount of traffic to be handled. The tractor system is reported to be giving good service in France, but it is rather inflexible and somewhat expensive to install. For the short-haul system, where many barges are to be handled, it is not particularly attractive, and probably this reason has something to do with the determination to try a storage-battery equipment on the canal connecting Berlin with Brandenburg, where there are important brick fields. At all events the storage-battery system has been tried, as is noted elsewhere in this issue, and has given such good success that the original fleet of seven experimental barges has now been increased by 112 new vessels, all propelled in the same way.

The equipment, in brief, consists of a motor driving the barge, through a propeller, at about three miles an hour. Power is drawn from a storage-battery equipment weighing some ten tons, the charge of which is sufficient to carry the vessel from one end of the route to the other. At each end the batteries are charged without being removed, while the barge is loading or unloading as the case may be. Each trip requires about two days; the round trip, including loading and unloading, about a week, which is a reduction of seventy-five per cent from the time required to do the work by the old method of animal traction. Not all of this gain has been due to the increased speed of the boat, as a considerable part of it has been secured by the addition of suitable unloading and loading equipment at the quays. The cost of a single charge of the batteries, which is sufficient to propel the barge through fifty miles, is given as twenty-five marks or about $6.25. No comparative costs for other means of propulsion are given, but the new system is evidently eminently satisfactory.

The system as here used seems excellently suited for the short runs which are made. The cost of the service can not be great, as the barge is controlled by two men, a helmsman and an engineer.

For long-haul traffic the traction system seems to present some advantages over the accumulator. And when a trip requires a week's traveling say, it would probably be out of the question to equip the boat with a sufficiently large storage battery to carry it from one end to the other. It would be necessary in this case either to stop every day or so while the batteries were being charged or to remove the exhausted set and replace it with a fresh one. The former plan would not add very much to the time of the trip, for according to the descriptions of the Berlin-Brandenburg system the batteries are charged for a two-days' run during the six hours required to load or unload the boats. However, the plan of replacing exhausted cells by a fresh lot at fixed stations has some attractions, for in this way there would never be any necessity to tie up a barge because of a battery trouble, and the cells could then be charged at a lower rate, which might be more beneficial. These charging stations could be scattered along the canal and in many states obtain cheap power from hydraulic stations already in existence. By this plan it would be practicable to reduce the size of the batteries, allowing them to be replaced once a day. With suitable equipment for handling the batteries the exchange could be made in a very short time. Although the storage battery has not proved itself suitable for general traction purposes, it is making good headway in city automobile work, and the conditions on the canal boat should be even more favorable to it, as it would there be less subject to vibration and could be proportionally lighter in construction, and would have a longer life.

RECENT RESEARCHES IN RADIOACTIVITY.

Although not so much is heard to-day regarding the researches which are being carried on into that interesting physical phenomenon, radioactivity, as was heard a few years ago, the work is still being actively prosecuted and important facts are constantly being brought to light. The position at present reached was explained at a recent meeting of the Royal Institution, of London, by Professor Ernest Rutherford, who has been one of the most active and noted investigators of this branch of physics and to whom the discovery of some of the most important facts now known is due.

During this lecture several interesting facts were brought out. One of these is very striking, although if hardly seems likely, at the present time at least, to be of any practical value. The idea, however, is novel. According to the disintegration theory, which, in brief, attributes radioactivity to a disintegration, or breakdown, of the atoms of the active material, this disintegration is proportional to the number of atoms present. Experimental evidence, so far at least, supports this theory as the disintegration of a substance goes on at a rate decreasing geometrically. So far we have not found any way of influencing this rate. It is apparently fixed, at least so far as all influences which we can bring to bear are concerned. Every radioactive

substance has its own rate of disintegration, and, therefore, its activity will fall to half its initial value in a certain characteristic fixed time. This is a period of time which can not be altered by any means now at our command, and it can be determined accurately. It might serve, therefore, as suggested by Professor Rutherford, as a standard of time.

Another of the facts upon which emphasis was laid was the importance of the α radiation. As is well known there are three types of radiation which may take place during the disintegration: the α, the β and the γ. The former seems to be composed of particles about the size of hydrogen atoms, and this form of radiation is observed in almost every case of disintegration. The β radiation apparently consists of much smaller particles and is observed much more rarely than the α. The γ radiation has given rise to considerable discussion. At first it was thought to consist of pulses in the ether corresponding to a single pulse of light, but more recently it has been suggested that this radiation consists of neutral—that is to say, uncharged—bodies, and it, therefore, would not be deflected by magnetic or electric fields. The solution of this problem is rather difficult, but should it be found that the last explanation is correct, this will reduce all the radiations caused by the disintegration of the latter to a corpuscular nature. It seems that these different types of radiation differ somewhat when they arise from different substances, and this has made possible the separation of different stages during the disintegration of the original material, and has also made it possible to trace the descent of one material, such as radium, more accurately. It has been suggested that radium was a direct descendant of actinium, but a study of the facts just mentioned showed this not to be the case, and that there must be another material which is interposed between radium and the first product of disintegration of uranium. This, it is believed, has been separated by Dr. Boltwood and has been called ionium, and it is now thought that every generation in the lineage of radium is known and that its progeny can be traced until it becomes polonium.

Some of the latest work has been an attempt to study the effect of a single α particle. It was thought that this might be done by noting the ionizing effect which this would have upon a partially exhausted tube of gas, but so far these experiments have not been entirely successful. This is an important matter as it is not known definitely whether the α particle corresponds in size to the hydrogen atom or the hydrogen molecule. This must be known before it can be definitely proved that it becomes helium after having lost its charge.

PROGRESS IN SINGLE-PHASE RAILWAY WORK.

Although we have had, from time to time, descriptions of single-phase electric railway installations, up to the present time there has been no compilation showing just how much progress has been made. This has now been done by Mr. M. N. Blakemore in the February issue of the *Electric Journal*, and the statistics which he gives show very substantial progress. Indeed, the number of miles of railway and the number of cars now in operation are surprising. In brief, Mr. Blakemore shows that there are twenty-eight single-phase roads, having nearly one thousand miles of line, in operation or under construction. The number of miles of track must be considerably greater than this, as some of the roads mentioned are double-track, and one even has four tracks for a considerable stretch. The number of cars in use or being equipped for these roads is 240. The aggregate horse-power of the motors is over 137,000. Considering that the first road was started in December, 1904, only a little over three years ago, the record is excellent. This road, by the way, was the Indianapolis & Cincinnati Traction Company, which is now operating 116 miles of track. Another notable system is the Spokane & Inland Empire Railroad Company, which is operating 115 miles of track. The most notable equipment is that of the New York, New Haven & Hartford Railroad Company, where there are twenty-two miles of road. The type of equipment varies from two fifty-horse-power motors on a car to the four-motor New Haven locomotives with an equipment rated at 1,000 horse-power. Two recent notable locomotives have been built; one weighing 135 tons, which is for the Westinghouse Interworks Railroad, and a seventy-ton locomotive built for the Pennsylvania Railroad Company, which is designed for fifteen cycles.

As far as the frequency of the systems is concerned, twenty-five cycles seems to-day to be standard. Of the list of twenty-eight roads given, all but two operate at this frequency. These two are the Visalia Electric Railroad, and the Shawinigan Railroad, both of which are now under construction. The voltages of the trolley wire vary from 1,200 to 11,000; 3,300 seems to be the favorite potential, although 6,600 is frequently adopted. In city work, of course, the voltage is considerably lower—in the neighborhood of 500 or 600. In these cases the motors are usually operated in the low-potential part of the system by direct currents.

Another feature of this work is the universal adoption of the catenary system of suspension. This alone would indicate that the roads were intended more for cross-country service than for urban work, a fact which is also evident from the size of the equipments most generally employed. In all but a few cases the cars have four motors, rated at from fifty to 125 horse-power each.

From this brief synopsis of what is being done to try the single-phase railway system, it is evident that not only is the system being given a thorough trial, but it seems to be gaining in favor. If its popularity continues to increase, it will not be long before the effect upon the steam railroads of the country will begin to be seen. The fact that a number of the more important steam roads have already in service electrical sections, where they are trying out the single-phase system, shows the earnestness with which the steam railroads are following the new developments.

Testing of Steam-Electric Power Plants—II.

By Frank Koester.

THERE are several ways of testing auxiliaries. One method, probably the most successful of any, is to meter the boiler feed-water and at the same time measure the water of condensation of the prime movers. Subtracting this latter amount from the amount registered on the feed-water meter will give the steam consumption of the auxiliaries.

Another method is to connect the exhaust of the auxiliaries with that of a main prime mover discharging into the condenser. When this method is adopted the condenser to which the auxiliaries are connected must receive the exhaust from the auxiliaries alone and must not be run under a vacuum. This can be accomplished by opening a vacuum breaker or by slightly opening the atmospheric relief valve. In order to test the pumps of turbine No. I the exhausts of the pumps were connected to the condenser of turbine No. II. The circulating-water pump and the hot-well pump of turbine No. II being used to supply water and take care of the condensation. The air-pump was not operated as there was no vacuum required. The exciter engine and the boiler-feed pump, as well as the smaller auxiliaries, were tested in a similar manner.

The steam consumption of all the auxiliaries, as itemized in a separate article, "Steam or Electrically Driven Auxiliaries,"[1] is 5.9 per cent of the total steam consumption of the prime mover, or 750 pounds per hour.

EFFICIENCY OF HEATER.

The boiler feed-water is obtained at a temperature of 100 degrees Fahrenheit.[2] The temperature is raised in the closed heaters to 158.8 degrees Fahrenheit by the auxiliary exhaust, one pound of exhaust steam raising the temperature of seventeen pounds of water 58.8 degrees Fahrenheit. The drips of the heaters are saved by being connected to the suction of the boiler feed-pump through low-pressure steam traps. The oil is removed from the exhaust steam by means of an oil separator located in the exhaust line close to the heaters.

ALTERNATOR TEST.

The alternator is of the three-phase, sixty-cycle, revolving-field type, 2,300-volt. It is direct connected to the turbine.

As in all tests great care must be taken in order to make sure that all instruments used are accurate, and as standard switchboard instruments are not usually guaranteed to be accurate within less than two per cent, laboratory portable instruments were used with correction factors.

For convenience the test was divided as follows:

(*a*) Iron loss.
(*b*) Resistance of armature (C^2R loss).
(*c*) Resistance of field (C^2R loss).
(*d*) Saturation curve.
(*e*) External characteristic.
(*f*) Insulation tests.
(*g*) Heat run.

(*a*) The total iron loss was determined by first running the alternator without any field and then running at normal line voltage, separately exciting the field, care being taken to hold absolutely constant

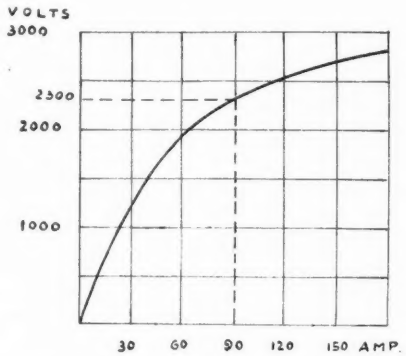


FIG. 6.—SATURATION CURVE, NORMAL SPEED, NO LOAD.

speed. The difference in power required at no voltage and at normal voltage is the total iron loss, friction and windage losses being practically constant and so small as to be negligible.

(*b*) The resistance of the armature was determined from Ohm's law by passing a known current through it and reading the drop. The C^2R losses for all loads were then figured from this.

(*c*) The C^2R loss in the field was determined in the same manner as in the armature. These two C^2R losses constitute the total copper loss in the machine and are plotted on the accompanying curve sheet.

(*d*) The saturation curve was taken for both no load and full load. For the former the armature circuit is opened and the alternator run at its rated frequency. The field current is then varied from 0 up to twenty-five or thirty per cent above normal, and readings made of the terminal voltage. The full-load curve was obtained in the same manner, except that the armature circuit was closed through a water rheostat or some other variable non-inductive resistance, by means of which the line current is held at normal. It will be noted that the terminal volts on the full-load saturation curve are lower than those on the no-load curve. This, of course, is due to the impedance drop and armature reaction.

(*e*) The external characteristic of an alternator is the relation between the terminal volts and the armature current with non-inductive load. The machine was run at its rated speed and no-load voltage. Keeping the field current constant, close the armature circuit through a water rheostat or other ohmic resistance and note the terminal voltage at varying loads from no load to about fifty per cent overload. Great care must be taken to keep the field current and the frequency constant. This is a very important test as it shows the voltage regulation of the unit, and with load of a varying character is what determines the advisability of adopting an auxiliary voltage regulator.

(*f*) A separate insulation test was made on the field and armature by means of a transformer of several kilowatts capacity. One terminal of the transformer was connected to one side of the field or armature, and the other side to the other end of the machine winding through a variable resistance. The resistance was then calculated by means of Ohm's law. If the high-potential transformer is unavailable for this purpose, equally as accurate results may be obtained by using a Wheatstone bridge.

(*g*) There are several different methods of making heat runs on alternators, that most common for small-size units being to use water rheostats for load. This method is equally as feasible for units of large capacity, where the voltage is high, but where the normal current is very heavy it is a very difficult thing to hold the load constant on account of the heating and boiling of the water. A simple method of making a water rheostat is to take an iron box or an iron-lined wood (water-tight) box for one terminal and a bunch of scrap iron tied to a rope which passes through a pulley for the other terminal. An iron ash can makes a very good water rheostat. Of course when

[1] ELECTRICAL REVIEW, February 8.

[2] The temperature of the hot-well water was several degrees lower, but owing to the fact that the drip from the feed-water heaters was connected to the suction of the boiler-feed pumps this temperature (100 degrees Fahrenheit) was obtained.

2,300 volts is to be placed on a water rheostat the water box must be placed on porcelain insulators, and if one attempts to stir the salt in the water while load is on he must be very careful in removing the pole or whatever he uses for a paddle not to let the salt water run down to the hand while the stick is in contact with the box, as this makes an excellent ground through the body.

While the boilers and turbine were tested with the alternator supplying the line, for the generator test three water rheostats were rigged up in the basement in order to keep the power-factor at unity. These rheostats consisted of iron-lined wood boxes set on porcelain insulators with a large iron plate suspended vertically in each, and counter-weighted on a fixed pulley so as to facilitate operation. The three boxes were connected in Y.

Before starting the run thermometers were placed at several points around the machine in order to determine the average room temperature, and also at one or two points on the stationary parts of the machine.

The machine was then started and run under normal load for ten hours, readings being taken every half hour. The machine was then shut down and thermometers placed on all the current-carrying parts of the generator, as well as on the armature and field iron and on the bearings. It is important to read the temperature of both the leading and lagging pole-tips of the field. If overload temperatures are desired, the machine is started up again and run till constant at normal load and the overload applied and readings made in the same manner. Of course the field and armature-winding temperatures may be checked by reading the resistance cold and hot, and figuring the rise in temperature, allowing an increase in resistance of 0.004 per degree Centigrade.

In the above method of making a heat run of course a large amount of energy is wasted, so that it is an undesirable method unless it can be used at the same time that steam tests are being made on the boilers and turbines. It is also impossible to get non-inductive loads under the normal operation of a plant. To overcome these objections the following method may be employed:

First run the machine with the armature circuit open and the field current normal, making temperature readings as above; then short-circuit the armature and run with normal armature current and make temperature readings. Another method is to reverse the connections to some of the field spools and run with normal field current and normal armature current on short-circuit. The water rheostat is superior to either of these when possible, as in the two latter methods the iron losses due to eddy currents and hysteresis are increased and the temperatures consequently increased.

EXCITER TEST.

Tests on the exciter are made in the same way as those described above for the alternator, except that the water rheostat heat run method would always be used and the external characteristic would be the compounding curve.

Another important test on the exciter is to operate at varying loads from 0 to fifty per cent overload and note the commutator. The machine should be capable of standing this load variation without shifting the brushes and without injurious sparking. It might be mentioned here that these brushes add materially to the friction losses and this loss may be determined by running with the brushes lifted up and then down with open field and armature circuits.

Insulation tests on the wiring throughout the plant are made in the same manner as on the machine windings. Loss of potential in the wiring may be determined by running under normal load and measuring the voltage at different points. These readings really do not amount to much, as they depend so largely upon the power-factor, which in all our tests is unity.

RESULTS OF ALTERNATOR TEST.

It was found that after the ten-hour normal heat run at unity power-factor no part of the machine showed a rise in temperature of more than thirty-four degrees Centigrade, and after the two-hour, fifty-per cent overload run, also at unity power-factor, the highest temperature recorded was fifty-two degrees Centigrade.

The voltage regulation from no load to full normal load (non-inductive) was found to be about six per cent, with comparatively small falling off up to fifty per cent overload. The regulation was taken according to the standard of the American Institute of Electrical Engineers, by running at a constant speed under the given load and throwing the entire load off at once, the percentage voltage rise being the regulation.

RESULTS OF EXCITER TEST.

It was found that the compound curve was practically uniform from no load to full load, with a maximum rise of five per cent. After the normal full load heat run the maximum temperature, that of the commutator, was found to be thirty degrees Centigrade above that of the surrounding room, and after the fifty per cent overload run the maximum temperature of the winding was forty-four degrees above the surrounding air, and the commutator fifty-five degrees above the atmosphere, which was thirty-six degrees Centigrade.

CONCLUSION.

The total efficiency is given in the following table; the heat losses per pound of coal are given in percentage and British thermal units. This table shows the total efficiency of the plant to be twenty per cent:

Subject.	Losses in B. T. U. and Percentage per Pound of Coal.	
	13,410 B. T U.	100%.
Ashes	201	1.5
Radiation and leakage of boilers	537	4.0
Radiation and leakage of flue	134	1.0
Gases through chimney	1,878	14.0
Blow-off and leakage	201	1.5
Radiation and leakage of piping	201	1.5
Friction and leakage of turbine	134	1.0
Rejected to the condenser	8,180	61.0
Electrical loss	27	0 2
Required for all auxiliaries	801	5.9
	12,294	91.6

Returned by feed-water heater 8.6 per cent = 467 British thermal units

Delivered to bus-bars 103.6—91.6 = 12 per cent, or 1,509 British thermal units.

Central Electric Railway Association Adopts Uniform Accounting.

A meeting of the auditing conference of the Central Electric Railway Association was held at Lima, Ohio, on February 11. The rapid increase in interline passenger and freight traffic over the electric trolley systems of Ohio, Indiana and Michigan has made imperative the adoption of uniform accounting systems. The classification of operating expenses to comply with the requirements of the respective state and interstate commissions, the handling of interline claims, settlement at junction points, overcharges, excess, interline ticket balances and uniform blanks for ticket and freight accounts were taken up and preliminary agreements entered into. M. W. Glover, of Cincinnati, Ohio, presided, and C. B. Baker, of the Western Ohio Traction Company, of Lima, was chosen secretary of the organization which was perfected. The next meeting will be held in March.

FINANCIAL REPORTS OF ELECTRICAL COMPANIES.

THE NEW YORK & NEW JERSEY TELEPHONE COMPANY.

The annual report of the New York & New Jersey Telephone Company shows higher earnings for 1907 than for any previous year, the net earnings equaling 8.42 per cent on the stock. The gross earnings for the year ended December 31, 1907, were $8,807,093. The net earnings were $2,228,950. After deducting charges and dividends there was a surplus of $451,430, which, added to the previous surplus, makes a total surplus of $4,877,325. The gross earnings were divided as follows: Exchange service, $4,288,576; pay stations, $921,394; tolls, $3,079,619; leased lines and instruments, $37,168; real estate, $298,679; other income, $181,697.

At the annual meeting, at which this report was presented, the directors submitted a statement to the stockholders in connection with the announced defalcation of Henry Sanger Snow, late treasurer of the company. It appears that in December, 1906, the company made an offering of stock to stockholders pro rata at par. In January, 1907, under rights which accrued to Mr. Snow as a stockholder, or were acquired by purchase in the open market, he subscribed for 1,670 shares of the new stock. Under this subscription certificates for 1,000 shares were issued to Mr. Snow, and for 670 shares to F. G. Webb, a clerk in Mr. Snow's office. The certificates for the Webb stock were receipted for by "F. G. Webb, per H. S. S." Mr. Webb states that at Mr. Snow's direction he executed blank powers of attorney for the transfer of these certificates and delivered them to Mr. Snow, understanding that they were to be used in the company's interest. The total thus subscribed for by Mr. Snow in his own name and that of Mr. Webb was 1,670 shares, par value $167,000. The report states:

"Under the terms of the subscription payment was to be made in four equal installments, on February 1, May 1, August 1 and November 1, respectively.

"On February 28, 1907, the date of the first payment, Mr. Snow entered or caused to be entered on a sheet headed 'Treasury Advances,' and kept in his office, an item of $15,000, this without the approval or authority of the board of directors, executive committee or any officer of the company. On March 11, $10,000 of this $15,000 was repaid.

"On May 3 cash payments were made sufficient in amount to discharge the balance of the February 28 unauthorized advances ($5,000), and to credit the two accounts with $55,000, a total of $60,000. On May 2 and 3 there were sold and transferred to other parties 400 shares of the Snow stock and 200 shares of the Webb stock, a total of 600 shares, $60,000. The payments of August 31 and November 30 were offset by unauthorized advances.

"Other unauthorized cash advances were made by Mr. Snow both before and after those above mentioned, the aggregate of all improper advances outstanding on February 6, 1908, the date of his resignation, being $139,370.72.

"Mr. Snow delivered to his successor all treasury stock and all other securities in his custody as treasurer, except twenty-nine of the company's five per cent gold bonds of the issue of 1890 ($29,000), which had been purchased and were in the treasury for retirement and cancellation under the operation of the sinking fund. These bonds Mr. Snow had used as collateral on personal loans at banks and trust companies and in support of his personal accounts at brokers, and was therefore unable to deliver them when demanded.

"There was no over-issue or invalid use of stock. Every certificate issued was properly signed, sealed and registered. No bonds were improperly issued. The irregularities, so far as the issue of stock was in any way affected, were wholly in the cash account. The bonds, properly issued and in the treasury, were improperly appropriated and used. The foregoing items aggregate $168,370.72. The company has recovered on Mr. Snow's surety bond $20,000, making the maximum loss $148,370.72. Steps have been taken to recover the equity in collateral on Mr. Snow's personal loans, which is estimated at $30,000, which makes the net approximate loss to the company $118,370.72.

"By a vote of the board of directors the maximum loss, $148,370.72, has been charged to profit and loss, leaving the surplus $4,728,953.77.

"Whatever the company recovers from equities, estimated at $30,000, will be credited to surplus."

The company, after a complete investigation, exonerated Mr. Webb from complicity in the transaction.

H. F. Stevens was elected a director to succeed Mr. Snow. Mr. Stevens is a Syracuse man who has been identified prominently with the telephone business for several years. All the other directors of the company were re-elected.

THE BELL TELEPHONE COMPANY OF PENNSYLVANIA.

The annual report of the Bell Telephone Company of Pennsylvania shows that for the year ended December 31 last the gross earnings were $7,670,439.42. The expenses were $5,195,907.76. The earnings over operating expenses were $2,474,531.66. Deducting the interest and dividends, the balance to surplus is $570,534.69. Added to the surplus on January 1, 1907, this gives a surplus on December 31 of $2,228,437.37. Additions to construction in 1907 were as follows: Real estate, $230,760.64; underground plant, $915,222.27; ærial plant, $561,482.39; equipment, $719,931.89, a total of $2,427,397.19.

The company issued $1,750,800 of its capital stock in exchange for capital stock of the Chesapeake & Potomac Telephone Company, at the ratio of $100 to $150.

In the latter part of the year 1907 the Bell Telephone Company of Philadelphia acquired the assets and assumed the liabilities of the Pennsylvania Telephone Company and the Delaware & Atlantic Telegraph and Telephone Company of Pennsylvania. Subsequently the company changed its name to the Bell Telephone Company of Pennsylvania.

The station statement for 1907 is as follows: In service January 1, 1908—Philadelphia, 102,023; elsewhere, 123,382, making a total of 225,405, a gain for 1907 of 7.14 per cent.

The officers of the company are: U. N. Bethell, president; F. H. Bethell, vice-president; W. S. Piersol, secretary and treasurer; J. S. Wiley, auditor; P. L. Spalding, general manager; L. H. Kinnard, general contract agent.

CHICAGO TELEPHONE COMPANY.

The annual report of the Chicago Telephone Company for the year ended December 31, 1907, shows earnings for dividends of $1,742,083, as against $1,618,144 in 1906. The gross earnings increased about $800,000 and the expenses about $700,000. The plant is valued at $23,324,112; the real estate and buildings at $2,320,034, and material, $766,798. The net increase in telephones in service at the end of the year was 31,847. There were in service on December 31 in the Chicago Exchange system 145,480 telephones; in the neighborhood exchanges of Chicago, 10,599; in the suburban ex-

changes, 46,602, making a total of 202,681.

The state of Illinois has given the company permission to increase its capital of $20,000,000 to $30,000,000. The purpose of this increase is stated to be to pay off debts and for building and rebuilding plants and extending the service. The issue will first be offered to the present stockholders and if not all taken by them will be offered in the open market.

ANNUAL REPORT OF THE CHICAGO CITY RAILWAY.

The annual report of the Chicago City Railway Company, which includes eleven months' operation under the new franchise ordinance, was submitted to the stockholders at the meeting held on February 20. The figures indicate that the property has made rapid strides to the fore in the matter of improvements and in business resulting out of better service since the rehabilitation work has been in progress.

The company's income and expense account for eleven months ended December 31, 1907, which represents the period under the new franchise arrangement, is given as follows: Passenger receipts (January excluded), $7,460,634; receipts from other sources (January excluded), $102,059; total, $7,562,694. Operating expenses, taxes, renewals and interest on capital invested, as approved by board of supervising engineers, $6,410,272; net earnings for eleven months, $1,152,421. City's proportion, fifty-five per cent, as per ordinance, $683,831; company's proportion, forty-five per cent, as per ordinance, $518,589. Interest on capital, as certified by board of supervising board of engineers, $1,116,386; income from operation for eleven months, $1,634,976. Other income from January operations, etc., $281,581; net income, $1,916,558. Dividends (decrease, $405,000), $1,215,000; surplus for the year, $701,558.

President T. E. Mitten says: "Three hundred cars of the new 'pay-as-you-enter' type have been purchased, 150 of which have been placed in service, resulting in almost eliminating the large number of accidents brought about by passengers attempting to board or leave moving cars. The proportion of fares collected to passengers carried has also materially increased, due to the collection of fares by conductor upon rear platform.

"The entire number of double-truck cars required to be supplied under the ordinance during the three-year period has now been secured. Thirty-one and fifty-one-hundredths miles of new track have been reconstructed during the past year under the provisions of the settlement ordinance, of which approximately ten miles was in replacement of cable tracks removed."

THE CHESAPEAKE & POTOMAC TELEPHONE COMPANY.

The gross earnings of the Chesapeake & Potomac Telephone Company for the year ended December 31 last were $2,878,504, an increase of $426,428 over last year. The net revenue was $826,090. The balance to surplus was $117,042. The station statement showed that on January 1, 1908, there were 31,339 stations in Washington, 34,825 in Baltimore and 12,561 elsewhere, a total of 78,725, as against 70,167 on January 1, 1907. The balance sheet shows a reduction in the bonded indebtedness from $1,344,000 on January 1, 1907, to $1,318,000 on January 1, 1908. Bills payable have increased from $7,000,024 to $8,000,000 during the same period.

CENTRAL DISTRICT AND PRINTING TELEGRAPH COMPANY.

The Central District and Printing Telegraph Company reports gross earnings for the year ended December 31 last of $4,386,496, against $3,901,310 in the previous year. The net earnings were $1,112,883, against $952,752; and a surplus after dividends of $93,403, against $92,752, was shown. The directors were re-elected, with the exception of George I. Whitney, whose place was filled by W. R. Driver, of Boston.

THE INTERBOROUGH-METROPOLITAN COMPANY.

President Theodore P. Shonts, of the Interborough-Metropolitan Company, has prepared a statement to be forwarded to stockholders in response to requests made at the annual meeting held on January 21 last. In order to remove an erroneous impression which seems to prevail, it should be stated that no railroads of any kind are operated by the Interborough-Metropolitan Company. That company is a business corporation, a holding company owning stock in the Interborough Rapid Transit Company, operating the subway and elevated systems in New York city; the Metropolitan Street Railway Company, now in the hands of receivers, which owns a system of street surface railways operated, prior to the receivership, under lease by the New York City Railway Company, and the Metropolitan Securities Company, which owns the stock of the New York City Railway Company.

Securities of the Interborough-Metropolitan Company have been issued as follows: Collateral trust four and one-half per cent bonds. Total amount authorized, $70,000,000; issued and outstanding, $67,825,000. Preferred capital stock: Total amount authorized, $55,000,000; issued and outstanding, $45,740,000. Common capital stock: Total amount authorized, $100,000,000; issued and outstanding, $93,262,192.

The following shows the general balance sheet of the company's books as of December 31, 1907:

ASSETS.

Interborough Rapid Transit Company capital stock, at cost in securities of this company		$104,563,042.00
Metropolitan Street Railway Company capital stock, at cost in securities of this company		68,684,455.00
Metropolitan Securities Company capital stock, at cost in securities of this company		28,329,695.00
Metropolitan Securities Company, loans secured by three-year 5-per-cent improvement notes and stocks and bonds of subsidiary companies as collateral		8,844,700.48
Real estate, at cost		594,464.89
Office furniture and fixtures		5,461.06
Engineering, in suspense (additional subways)		50,114.78
Metropolitan Securities Company stock, full paid		36,773.46
Cash and accounts receivable		1,835,802.84
Total		$212,944,509.51

LIABILITIES.

Capital stock—Common	$100,000,000	
Reserved against outstanding stocks not acquired	6,737,808	
		$93,262,192.00
Capital stock—Preferred	$55,000,000	
Reserved against outstanding stocks not acquired	9,260,000	
		45,740,000.00
Col. trust 4½ per cent bonds	$70,000,000	
Reserved against outstanding stocks not acquired	2,175,000	
		67,825,000.00
Notes payable		4,545,000.00
Accounts payable		42,369.76
Accrued interest for 3 months to January 1, 1908, on Interborough-Metropolitan 4½ per cent bonds (covered by dividend of Interborough Rapid Transit Company, paid December 31, 1907)		763,031.25
Income account, surplus		766,916.50
Total		$212,944,509.51

Mileage of companies comprising the Interborough-Metropolitan system:

Interborough Rapid Transit Company—	Miles.
Subway	72.48
Elevated	118.05
Surface lines owned or controlled by Interborough Rapid Transit Company	154.03
New York City Railway and subsidiary companies	519.46
Total (single track)	864.02

The New York City Railway Company having defaulted in the guaranteed divi-

dend of seven per cent on the $52,000,000 of stock of the Metropolitan Street Railway Company, receivers were appointed on September 24, 1907, to take charge of the property, and on October 1, 1907, receivers were also appointed of the property of the Metropolitan Street Railway Company. As a result of this default the Interborough-Metropolitan Company has received no dividends since that date on its holdings of Metropolitan Street Railway Company stock, and has consequently been obliged to discontinue the payment of dividends on its own preferred stock. These dividends, however, are cumulative.

The earnings of the Interborough Rapid Transit Company continue good; the surplus for the year ended June 30, 1907, after the payment of all interest charges, the guaranteed dividend on Manhattan Elevated Railway Company stock and dividend on its own stock, being $566,443.70, as against $281,390.70 for the previous year, an increase of $285,053. The surplus for the last six months of the calendar year shows a gain over the corresponding period of last year, and the under-river section of the Brooklyn extension, which was opened for operation on January 9, 1908, is adding to this surplus at the estimated rate of $700,000 per annum. It is also anticipated that a further increase will result from the opening of the remainder of the Brooklyn extension, about April 1, 1908.

The dividends of nine per cent per annum upon the Interborough Rapid Transit Company's stock, received by the Interborough-Metropolitan Company, are used exclusively for the payment of the interest upon the Interborough-Metropolitan Company's four and one-half per cent bonds, against which the Interborough Rapid Transit Company's stock is held in trust as collateral. Any dividends earned and declared over and above this amount will inure to the benefit of the Interborough-Metropolitan Company.

TWIN CITY RAPID TRANSIT COMPANY.

The Twin City Rapid Transit Company reports for the year ended December 31, 1907, gross earnings of $6,055,742; net earnings of $3,075,307. Dividends were paid amounting to $1,215,000, which, added to expenses, interest and taxes, leaves a surplus for the year of $637,137. There were applied for renewals $506,000, leaving a net surplus of $131,137. After deducting seven per cent on the preferred stock, the balance for common dividends before charging off depreciation was equal to 8.1 per cent on the $20,000,000 capital stock outstanding. A comparison with the accounts of last year shows the increase in gross passenger earnings to be $428,462. But for the financial trouble in the last quarter of the year the increase would probably have aggregated $500,000. Operating expenses increased $305,055; net earnings show an increase of $105,698.

The car service has been considerably improved, the car mileage being increased 2,513,089 miles. The rates of wages paid to all employés have also been increased, as has been done on previous occasions when the earnings warranted it.

New construction work to the amount of $1,657,154 was done during the year.

There were issued and sold to the public $800,000 consolidated five per cent bonds, due 1928. There were also issued and purchased by the company, for the renewal and reserve funds, as stated above, $574,000, thus making a total issue during the year 1907 of $1,374,000.

KINGS COUNTY ELECTRIC LIGHT AND POWER COMPANY.

The report of the Kings County Electric Light and Power Company for the year ended December 31, 1907, contains the earnings of the Edison Electric Illuminating Company of Brooklyn, as the latter's entire capital stock is owned by the Kings County company. The combined earnings of the two companies for the year are as follows: Gross, $3,471,740; expenses, $1,786,395; net earnings, $1,685,345. Deducting depreciation of $242,932, bond discount of $50,000, and fixed charges of $606,560, leaves a surplus of $785,853. Dividends were paid amounting to $764,000, leaving $21,853 to add to the previous surplus, making a total surplus of $1,181,213. The net surplus shows a decrease of $15,000, while the gross earnings increased $475,000.

At the beginning of the year the directors adopted the policy of charging to expenses a sum equal to one-half cent per kilowatt-hour of current sold in each month as a suitable provision for depreciation and replacements not provided for by repairs made and charged regularly to operating expenses. The aggregate sum so charged in the expenses during the past year is $242,931, and the net credit to this fund at the end of the year, after deducting previous replacements, is $294,759.

The company has 1,388 miles of overhead circuits and 518 miles of underground circuits, all in conduits owned exclusively by it.

The franchises of the company have not been capitalized. These franchises are all perpetual and are valued by the State Board of Tax Commissioners for purposes of taxation for the year 1907 at $10,100,000.

At the annual meeting the retiring board of directors was re-elected.

HUDSON RIVER TELEPHONE COMPANY.

The Hudson River Telephone Company shows a deficit, after dividends, for the year ended December 31, 1907, of $2,174. This compares very favorably with a deficit of $63,178 in 1906. The gross earnings were $1,474,308, as against $1,199,679 in 1906. After deducting interest and paying dividends amounting to $117,279, the total surplus remains at $202,995. The gross earnings increased 22.8 per cent; expenses increased 17.6 per cent; net earnings increased 45.5 per cent.

At the annual meeting, held in Albany, N. Y., the old directors were re-elected.

PACIFIC TELEPHONE AND TELEGRAPH COMPANY.

The Pacific Telephone and Telegraph Company shows a surplus, after dividends and charges, of $315,108 for the year ended December 31, 1907. The gross earnings were $9,223,564. Dividends were paid to the amount of $1,080,040, which, added to expenses, taxes and interest, left a surplus of $315,108.

The total number of subscribers on December 31, 1907, was 301,469. There were 1,778 exchanges and toll offices, and 31,325 miles of long-distance circuit.

BELL TELEPHONE COMPANY OF CANADA.

The gross earnings of the Bell Telephone Company of Canada for the fiscal year ended December 31 last were $4,829,656, against $4,139,334 last year. The net earnings were $3,875,859, against $3,146,479 last year. The dividends paid were $871,018, against $726,677. At the close of 1907 the company had a total of 111,118 stations, an increase of 15,973.

THE GENERAL ELECTRIC COMPANY.

The report of the General Electric Company for the year ended January 31, 1908, will show a gross business of approximately $70,000,000, which compares with $60,071,883 in the preceding fiscal year. The ratio of profits to business billed was about fourteen per cent, or about the same as in the preceding year, which will bring the net earnings on the $70,000,000 of business billed up to approximately $9,800,000, an increase of about $1,400,000

as compared with the fiscal year ended January 31, 1907. The current depression in business did not begin materially to affect the shipments of the company until January of this year. In that month it is understood that shipments aggregated about $4,400,000, or at the rate of $53,000,000 a year, as compared with $70,000,000 for the full fiscal year ended January 31, 1908.

President Coffin, in his last annual report, called attention to the fact that the sales billed for the first two months of the fiscal year ended January 31, 1908, were more than fifty per cent greater than in the corresponding period of the preceding year; also, that the total stock issued and subscribed aggregated $65,134,300, and that there had been authorized, but not issued or subscribed, $14,819,866, making a total outstanding and authorized capital of $80,000,000. Shortly after the annual report was made public the General Electric directors voted to offer stockholders approximately $13,000,000 five per cent convertible bonds at par. These bonds have all been sold.

General Electric directors have declared the regular quarterly dividend of $2 per share, payable April 15 to stock of record March 4.

NATIONAL CARBON COMPANY.

The National Carbon Company reports for the year ended January 31, 1908, net earnings of $924,801. Preferred dividends amounted to $315,000; common dividends to $220,000; depreciation and other charges to $355,050, leaving a surplus for the year of $34,750. After charging off preferred dividends and before charging off depreciation, etc., the surplus was equal to 11.07 per cent on the common stock. Deducting depreciation, etc., the surplus for the common, after preferred dividends, would equal 4.62 per cent.

At the annual meeting of the company, held in Trenton, N. J., all the directors and officers were re-elected.

Edison Operated On and Improving.

Thomas A. Edison was operated on for an abscess in the ear on Sunday, February 23, by Dr. Arthur B. Duel, at the Manhattan Eye and Ear Hospital, New York city. It is announced that while the ear affected was the same one upon which an operation for mastoiditis was performed three years ago, there were no symptoms of a return of that disease. The operation has been entirely successful, and no complications are expected. Dr. Duel stated that Mr. Edison was in no danger, but would probably be confined to the hospital for a week or ten days.

Westinghouse Lamp Company Discharges Receivers.

On application made on Monday, February 24, to the United States Circuit Court, at Trenton, N. J., by George Whitefield Betts, Jr., counsel for Receivers Drury W. Cooper and Theodore W. Siemon, of the Westinghouse Lamp Company, the court entered an order approving the accounts and reports of the receivers and directing them to turn over to the company all the assets and property of the company, wherever situated.

All of the capital stock of the Westinghouse Lamp Company is owned by the Westinghouse Electric and Manufacturing Company, of Pittsburg. A similar application for the release of the property of the Westinghouse Lamp Company from the ancillary receivership in the Southern District of New York has also been applied for. It was shown to the court that the company, from the time of the appointment of receivers to the present, had earned $50,000 net profit. The present liabilities of the company are about $300,000, and the assets $2,500,000, exclusive of good will, patterns, etc. Under the order the company agrees to pay in full all creditors with claims of less than $500. All creditors with claims in excess of that amount are to be paid by January 1, 1909, with interest.

The affairs of the Westinghouse Electric and Manufacturing Company, at Pittsburg, are shaping out nicely, and it is expected that the company will be out of trouble in a short time. It has been announced that the Westinghouse Machine Company may be taken out of the receivers' hands next week.

Side Doors for Subway Cars.

For some time Bion J. Arnold has been studying the problem of increasing the carrying capacity of the New York city subway, and in a report which has been made to the Public Service Commission Mr. Arnold recommends that side doors shall be put, not in the middle of the cars, but at the ends, so that they shall really be a continuation of the platform doors. He says that the additional side doors at the ends of the cars will reduce the waits at the stations in the rush hours, and will remove the conflict caused by the efforts of passengers to enter and leave the cars by the platform doors.

Mr. Arnold also urges that all cars be provided with pneumatic or other means for quickly opening or closing the doors, and with signals which will automatically indicate to the motorman when the last door is closed.

Mr. Arnold says that present conditions lead to the holding of trains, on an average, at the express platforms for fifty-five seconds. With side doors the total average time of express trains at stations would not be more than thirty seconds. The new doors can be used for exits and the present end doors for entrances. This provides at once the means of carrying on the loading and unloading simultaneously, providing a separate space for leaving passengers to collect around the exit doors without blocking the space which should be provided for the passengers entering the car.

Tunnel Between New York and New Jersey Opened.

The first section of the tunnel system of the Hudson & Manhattan Railroad Company, a description of which is given on other pages of this issue, was formally opened on the afternoon of February 25. At 3.40 P. M., President Roosevelt pressed a button in Washington which switched on the operating current in the tunnels, and the train with the invited guests proceeded from the station at Nineteenth street and Sixth avenue, New York, to Hoboken, N. J. At this point formal exercises were held. Walter G. Oakman, president of the Hudson Companies (the constructing and financing company), turned over the system to William G. McAdoo, president of the Hudson & Manhattan Railroad Company (the operating company). Mr. McAdoo replied for the officers and directors of his company. A letter of felicitation was read from President Roosevelt. Speeches were made by Governor Charles E. Hughes, of New York; Governor J. F. Fort, of New Jersey; Mayor Steil, of Hoboken; Mayor Wittpen, of Jersey City, and President McGowan, of the Board of Aldermen, New York city. In the evening a banquet was held at Sherry's.

The United Company's Annual Dinner.

The annual beefsteak party of the employés of the United Electric Light and Power Company, of New York, took place on the eve of Lincoln's Birthday.

Following the dinner an outline of the work of the year was given by F. W. Smith, secretary of the company. Remarks were also made by Joseph Swallow, superintendent of construction; W. E. McCoy, electrical engineer; S. D. Sprong, assistant electrical engineer; L. A. Coleman, assistant secretary, and T. I. Jones, manager sales department, and others. Following the speech-making a vaudeville entertainment was given by talent taken from the United Company's own force.

Ithaca Section of the American Institute of Electrical Engineers.

A meeting of the Ithaca section of the American Institute of Electrical Engineers was held on Friday, February 7. This was preceded by an informal dinner given in the physics dynamo laboratory of Rockefeller Hall, Cornell University, at which Charles F. Scott, consulting engineer of the Westinghouse Electric and Manufacturing Company, was the guest of honor. This was the first dinner of the Ithaca section, and was a pronounced success, as about 100 local members sat down at the table.

Following the dinner a meeting was opened by Chairman E. L. Nichols, who introduced Mr. Scott. Mr. Scott delivered an address on "Limitations in High-Tension Transmission." He took occasion to give his views on the recognition of limitations in general, particularly as applied to conduct, and he emphasized the general relation of technical education to engineering practice. He then took up the main theme of his address and showed how development has from time to time depended upon limitations in some part of the electrical equipment; for example, the voltage which could be economically developed, or the speed at which the generators could be run, or the sizes in which transformers could be constructed. Emphasis was laid upon the improvement in the transformer by which the operation of electric transmission has been enormously extended.

One of the most interesting features of the lecture was a general explanation of how limitations affect design. As an example it was pointed out that at the present time bridges are built primarily to support their own weight, the moving loads which they have to carry being of minor importance. However, should a much stronger material be found, the design might then be decided by the load which must pass over the bridge.

Forestry Meeting of the American Institute of Electrical Engineers.

A special meeting of the American Institute of Electrical Engineers will be held in the auditorium of the Engineering Societies Building, Thursday evening, March 5, at eight o'clock, when Gifford Pinchot, forester of the United States Department of Agriculture, will deliver an illustrated lecture on "Forest Preservation." This lecture will be open to the public and tickets will not be required.

Electrical Supplies for the Navy Department.

The Bureau of Supplies and Accounts will open bids in Washington, D. C., on March 10 for the following electrical supplies: 460 vibrating bells, 74,200 feet interior cable, 54,000 feet twin conductor, 7,000 feet single and double conductor, 5,000 feet of bell wire, 1,600 conduit unions, for delivery at Mare Island, Cal.: 460 vibrating bells, 74,200 feet interior cable, 54,000 feet twin conductor, 7,000 feet single and double conductor, 1,600 conduit unions, 237,000 feet steel enameled conductor, and 5,000 feet of bell wire, for delivery at Puget Sound, Wash.: ninety-two vibrating bells, 13,800 feet interior cable, 237,000 feet steel enameled conductor, 10,800 feet twin conductor, 5,000 feet single and double conductor, 320 conduit unions, and 1,000 feet of bell wire, for delivery at Brooklyn, N. Y.; 184 vibrating bells, 33,600 feet interior cable, 32,400 feet twin conductor, 2,800 feet single and double conductor, 640 conduit unions, 237,000 feet steel enameled conductor, and 2,000 feet of bell wire, for delivery at League Island, Pa.; 184 vibrating bells, 33,600 feet interior cable, 237,000 feet steel enameled conductor, 21,600 feet twin conductor, 2,800 feet single and double conductor, 640 conduit unions, and 2,000 feet of bell wire, for delivery at Norfolk, Va.

Susquehanna Power Company to Increase Power Development and Operate Toll Canal System.

A bill has been introduced in both houses of the Maryland legislature authorizing the Susquehanna Power Company to build twenty-nine miles of canals from Port Deposit, Md., to Columbia, Pa.

The bill amends the charter of the Susquehanna Power Company and enlarges its powers by recognizing its existing dam upon the Susquehanna River. It authorizes the company to build another dam or dams and transmission lines for electric power; to utilize its dams for navigation purposes, and, when connected by canals and taken to tidewater, to charge tolls for vessels passing through its pools and canals.

The plan as outlined is to enable the company to build dams with long pools back of them and to connect these by means of locks. Wherever it is necessary, there are to be constructed short pieces of canal, there being four miles of canal below the lowest dam, and others are to be connected with locks and dams. The work, when completed from Port Deposit, will supply navigable water for a distance of twenty-nine miles.

There is to be a canal four miles long from Lapidum to Shure's Landing, then a pool from the landing to Colbies Falls. From here there is one mile of canal to McCall's dam, and ten miles of pool following. From Lapidum the connection with Port Deposit is to be by means of a lock.

The incorporators direct attention to the fact that the state has for years been seeking an outlet by water, and backed the Susquehanna-Tidewater Canal, which remained in operation until it passed into control of the railroads, when it was abandoned.

Now the opportunity is again presented not only to restore navigation, but at the same time furnish a motive power which will materially cheapen the cost of lighting, with an estimated 100,000 horsepower.

BOOK REVIEW.

Whittaker's "Arithmetic of Electrical Engineering." New York. The Macmillan Company. Cloth. 160 pages. 5 by 7½ inches. Furnished by the ELECTRICAL REVIEW for 50 cents.

The title of this book shows a fault too common in certain technical works and particularly those by English authors. The title, "Arithmetic of Electrical Engineers," is rather misleading since the examples set deal entirely with physical relations and do not bring in any engineering methods; that is to say, there is no balancing between theoretical laws and practical considerations, the object of all the examples being to demonstrate the truth of the former. The book is rather suited to the first year's work in physics than to a demonstration of engineering principles. The treatment of the subject is very thorough, beginning with a discussion of general units, passing thence through the study of conductors, Ohm's law, work and power, divided circuits, heating effects of currents, electrochemistry, condensers and capacity, transmission and distribution, magnetic quantities, electromagnetism, magnetization of iron, and magnetic circuits, generators and motors. Under each heading the law to be demonstrated is stated but not proved and a number of examples illustrating it are given, there being in all about three hundred such exercises. In each case a worked example is given. The concluding section of the book gives answers to all the problems. The book should be a valuable assistance to the busy instructor in setting good exercises for his students.

THE NEW EIFFEL TOWER WIRELESS TELEGRAPH STATION.

BY C. L. DURAND.

The Municipal Council of Paris came to a decision quite recently regarding the erection of a new radio-telegraph plant at the Eiffel Tower. It will adopt the report which was presented to it by the military engineering corps and will carry out the plans for the new station which have been drawn up under the direction of Captain Ferrié. This latter officer and experienced worker in the "wireless" field had charge of the present small plant which was erected at the tower some three years ago, and is the inventor of different forms of apparatus, among others an electrolytic detector which has been applied at the tower station with good success. The plant which has been in operation at the tower was erected somewhat as an experiment, and was installed in several sheds of a rudimentary character. There was but a single mast wire hanging from the summit of the tower. Although the instruments were of the most modern design, and were kept in line with the recent improvements, the plant possessed but a small power, and was thus greatly limited in the distance which it could cover. Even with the present plant, however, the tower had a great advantage owing to its exceptional height (984 feet), and was able to communicate to all the radio-telegraphic stations on the French coast. It also made connection with the North African coast as far as Bizerta and Tunis, and it also receives signals from Casablanca, in Morocco, thus being useful on account of the recent French military operations in that country. Owing to the exceptional length of the mast wire, the station receives all the waves which pass in that direction, and which are not intended for it, and even the smallest waves can be detected.

This will give an idea of what can be done with the tower when a plant of sufficient size, and in proportion to the height of the mast wires, comes to be installed. At present the Nauen plant in Germany is the most powerful on the Continent, but the tower which is erected there is far from having the height of the Eiffel Tower. The Nauen plant is now able to cover great distances at sea, and these distances are being increased in the recent experiments. In view of these facts it would hardly be too much to say that the new tower plant will be able to send messages across the Atlantic.

After considerable negotiation, which has been carried on for the last few weeks, the Municipal Council decided favorably as to the erection of the new plant, and as a final measure a committee of delegates made an official visit to the tower in order to see what would be the best dispositions to adopt. These latter concern the arrangement of the new mast wires and the location of the "wireless" plant. The military engineer corps had already drawn up the plans for both these dispositions, and after a visit to the spot the plans were practically approved by the commission. The delegates received detailed explanations regarding the plant from Commandants Devisme and Chasles, and were quite satisfied with the same. In order to judge of the final appearance of the mast wires, a part of these had been placed temporarily in position on the tower. The accompanying engraving shows the maximum angle which will be occupied by the mast wires, according to the present plans. As a result of the visit made by the commission, it was finally decided to grant the authorization for the new plant, and its construction will be commenced within a short time.

THE EIFFEL TOWER, CHAMP DE MARS, PARIS, FRANCE.

One of the novel features of the new plant will be a large and well-equipped underground station which will contain all the apparatus for sending and receiving the messages. It will be located not far from the base of the tower in an underground chamber built of masonry and properly vaulted. This arrangement was adopted in preference to a building at the surface for two main reasons, suppression of noise and secrecy of the messages. In the present plant it is found that the explosion caused by the sparks of the apparatus can be heard for a considerable distance from the tower, and in fact over the whole extent of the Champ de Mars. With the extra power which is used for sending messages to the African coast the explosions can be heard even on the other bank of the Seine. This not only caused some inconvenience to the persons residing in the neighborhood, but, on the other hand, the signals could be received by sound by any one who was disposed to do so. This is, of course, a disadvantage which becomes considerable in time of war. Both these drawbacks will be suppressed by the use of the underground plant.

The arrangement which has been adopted for the mast wires which will be stretched from the summit of the tower to the ground calls for a network of wires, which is formed of four main descending wires together with a set of cross wires which inter-connect the former. The four main wires will be attached at the summit of the tower and will be brought down in nearly a straight line to four anchoring posts which will be erected on the ground of the Champ de Mars. These posts will be several metres in height and will have a decorative character which will be in keeping with the surrounding park. The cross wires will be lighter in size and the network as a whole will make a very effective antenna.

When the present plant is completed it will be one of the most powerful, if not in fact the largest, which has as yet been erected. It will be especially devoted to military purposes, and as such will prove a valuable aid. At the same time we may expect to see some great distances covered. Just what these will be is, of course, unknown at present.

A Busy Telephone Pay Station.

The telephone pay station in the basement of the Times Building has become one of the busiest pay stations of the New York Telephone Company. It has more calls than any other single-position station, and its business is brisk from 8 A. M. to 1 A. M. of the following morning. There is an average of ninety-two calls an hour from the station, that is, a call and a half each minute during the busy times of the day. Often during the other hours there is an average of a call every minute. The total exceeds a quarter of a million calls per annum. This surprising showing is the outcome of only eighteen months' growth.

SOME DEVELOPMENTS IN SYNCHRONOUS CONVERTERS.[1]

BY CHARLES W. STONE.

It is not the intention to make this paper a history of the development of the synchronous converter, but rather to point out some of the more important improvements which have been made in the last few years.

In this country the synchronous converter has become practically an indispensable piece of apparatus, some of the largest lighting and railroad companies being entirely dependent upon it. Abroad the conditions are different, as the motor-generator has been used almost exclusively until within the last few years, when the motor converter was introduced; as is well known, this machine being a compromise between the synchronous converter and the motor-generator.

It may be of interest to give at this time some idea of the increase in capacity of these machines in the last ten years on one of the large lighting systems, as this will give some idea of the tremendous development in machines of this type. In 1897, on the particular system in question, there was installed less than 1,000 kilowatts total capacity, and the largest machine was 500 kilowatts; on the same system in 1907, considerably over 100,000 kilowatts were in operation, the largest units being 2,000 kilowatts.

Most of the larger systems using synchronous converters operate at twenty-five cycles, but during the last four or five years many systems using sixty cycles have adopted synchronous converters and have found them very reliable.

I think it can be safely said that sixty-cycle synchronous converters, even when used for 600-volt railway work where the demands of the service are most severe, can be considered thoroughly reliable and successful, machines as large as 1,000 kilowatts being in successful operation.

The general tendency in the design of synchronous converters has been toward higher speeds, which would naturally mean reduction in the space occupied by them, lower first cost, less weight, etc. All these changes result in smaller buildings, cheaper foundations, and consequently lower fixed charges.

As an illustration of the changes that have been made, I shall cite one example. The 2,000-kilowatt, twenty-five-cycle, 250-volt synchronous converter as originally designed, operated at 115 revolutions and had twenty-six poles. It occupied a floor space 190 inches by 204 inches, and the total weight was approximately 186,000 pounds, whereas the newer vertical machine is circular in form, has eighteen poles, and operates at 167 revolutions. The diameter is 182 inches, and the total weight about 130,000 pounds.

Vertical Synchronous Converters—The vertical synchronous converter is so new that it seems advisable to point out some of its essential characteristics. The most novel features are in the shaft and bearings. The shaft, unlike that of the horizontal machine, is stationary; in fact it is nothing but a pedestal supported and fastened solidly to the foundations. There is only one bearing, which carries the entire weight of the revolving structure. This bearing in the first machine built consisted simply of two cast-iron plates, one of which was fastened to the top of the pedestal and the other being bolted to the spider of the armature. Oil is pumped up through a central hole in the pedestal and forced out between the cast-iron plates, forming an oil film on which the machine revolves, making practically a frictionless bearing.

In addition to the main bearing, use is made of the entire length of the interior of the spider for a guide bearing. A cast-iron sleeve lined with babbitt is fitted into the spider to form the bearing surface. As the only weight on this bearing is that due to the unbalancing of the rotating structure, the bearing should last indefinitely. The oil after leaving the top or supporting bearing, passes along the pedestal (thus oiling the guide bearing) down to the pocket at the base of the machine where it is drained off and used over again. Since the first machine was built, a new type of bearing has been tried which gives promise of success, although only a few months' experience has been obtained as yet.

The top part of the bearing is bolted to the armature spider and is similar to the top of the oil-pressure bearing, except that another hardened steel plate is doweled in place on the under part of this casting to form the wearing surface. Between these steel plates is a bronze carrier with a number of hardened-steel rollers placed radially, thus forming the roller bearing. Oil is pumped by a small low-pressure pump to this roller bearing and is drained off after passing through the guide bearing in exactly the same manner as with the oil step.

The stationary part carries the field spools and is split vertically so that the two halves can be drawn apart, making the armature accessible for inspection or repairs. This frame is supported on a number of cast-iron pedestals.

By the above construction it will be noted that the field frame is entirely independent of the rotating structure, making it easier to assemble the machine.

The armature being revolved around the pedestal, it is not possible to obtain any end-play, as in a horizontal machine. Some means must be provided to make the wear on the collector rings equal; this is accomplished by designing the brushes in such a manner as to make it possible to stagger them and thus cover the entire width of the collector rings. In addition there are placed on each ring some graphite brushes which act as lubricants. It is possible to walk around the machine and see and adjust all the brushes on both the commutator and the collector rings without climbing up on a bearing pedestal or going down into a pit, as would be necessary in a large horizontal-shaft machine. The bearings in the 2,000-kilowatt vertical machine can be taken out, inspected, and replaced in a little over two hours, which would hardly be possible in a horizontal machine of the same size.

The construction above outlined makes it possible to build machines occupying minimum floor space; in fact it has been found possible in stations which have been laid out for 1,000-kilowatt machines, horizontal shaft of the old type, to place a similar number of vertical machines of double the capacity.

Voltage Regulation—The next matter is that of voltage regulation. With a synchronous converter, as is well known, it is not possible to regulate the direct voltage of the machine by means of the field rheostat, as is done with a direct-current generator, without changing the power-factor; for the ratio between the impressed alternating voltage and the direct voltage is fixed by the design of the machine. Hence where voltage regulation is necessary, as for lighting work, charging storage batteries, etc., some means of changing the impressed alternating voltage is necessary.

A number of different methods have been used to accomplish this result, which I will describe briefly:

1. On the step-down transformers used with the converter, taps can be placed either on the primary or the secondary side and switches used to transfer from one tap to another. This scheme has many objections and is seldom used now. If the taps are on the primary, oil-switches would

[1] A paper read before the American Institute of Electrical Engineers, New York, February 14, 1908.

have to be used if the voltage were at all high. Such switches would be practically out of the question. If the taps are on the secondary, a dial-switch can be used but only with the smaller size machines, as it is difficult to build a dial-switch to handle large currents satisfactorily except at prohibitive expense. This method is also objectionable as it means fluctuation in the lights whenever the switch is moved to a different tap.

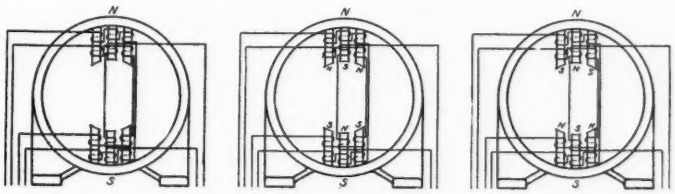
2. The common way of obtaining control of the voltage in railway work is to insert in the leads from the secondary of the transformer a reactance, thus furnishing a means of changing the impressed alternating voltage. This method, while simple and effective with the limited ranges in voltage required for such work, would not be applicable for large ranges in voltage. Too much reactance may cause pulsation troubles and it also has a bad effect on the entire system.

3. The arrangement in most general use to-day is to connect between the secondary leads of the transformer and the synchronous converter an induction regulator, by which it is possible to obtain almost any range of voltage within the capacity of the machine. This scheme of operation is in such general use that it will not be necessary to describe it in detail. The principal objection to this arrangement is that another piece of operating machinery is used with each synchronous-converter outfit, increasing the cost, requiring valuable floor space and making it necessary to open the secondary leads from the transformer, a serious complication with large low-voltage machines.

4. The next development in this line took place abroad, where an entirely different scheme was used. A few machines of this type have also been built by one of the large manufacturing companies in this country.

This method makes use of an alternating-current booster or bucker, mounted on the same base with the synchronous converter. The field has the same number of poles as the converter, and the armature is mounted on the same shaft as the synchronous-converter armature. Alternating current is generated in this armature and can be made to add its voltage to or be subtracted from the impressed voltage according to the direction of the excitation. This booster is usually placed between the collector rings and the main armature of the converter, and the taps from the collector rings are connected to equidistant points of the booster armature; similar points on the booster armature are connected to the synchronous-converter armature, thus placing the two in series, separate and distinct windings for each phase being used.

The principal objections to such an arrangement are that here again we have an additional operating machine, as in the case of an induction regulator. Extra weight is added to the shaft between its points of support. The ventilation of the converter armature and its accessibility are impaired. Any serious trouble with this smaller machine results in the dismantling of the main synchronous converter in order to repair the small booster.



FIGS. 1, 2 AND 3.—SHOWING SYNCHRONOUS CONVERTERS WITH SPLIT-POLE WINDING.

Another way to construct such a machine is to make it a revolving field machine, mounting the field on an extension of the shaft beyond the bearing of the collector-ring end of the synchronous converter.

As the armature is stationary, the leads from the secondary of the transformer are led directly to this winding, and from this winding to the collector rings of the synchronous converter.

This arrangement has the twofold advantage of being accessible, and not interfering with the ventilation or accessibility of the synchronous converter. This booster can be applied to any standard converter and, being overhung, it is possible to carry a spare machine, which can be placed in position quickly and without interfering with the body of the main synchronous converter.

5. The next development is very radical and is unlike any of the other schemes used. It was first proposed by J. L. Woodbridge some time ago. It has been known for some that the ratio of conversion between the alternating-current and the direct-current sides of a synchronous converter could be changed by varying the width of the pole-face. The Woodbridge method makes use of this idea in a very simple and yet effective way.

Fig. 1 shows a two-pole synchronous converter equipped in accordance with this idea. Each field-pole is divided into three sections, on each side of which are two windings. One of the windings on each section is the main shunt winding and the other is the regulating winding. All the main windings are connected in series and excited in the ordinary manner. The regulating windings, however, are connected differently. The windings on the two outer sections of all poles are connected in series with one another, and the windings of all the central sections are connected in series with one another, and these two groups are connected in series.

The voltage of the direct-current side of the converter is increased by exciting all the outer sections in a direction to assist the main shunt field, and the middle section an equal amount in opposition to the main field. This condition is shown in Fig. 2. If both these windings are excited in the opposite direction the direct voltage will be lowered. Fig. 3 shows this condition.

All that is needed in this arrangement is a field rheostat in the regulating-field circuit in addition to the main-field rheostat ordinarily used.

The first question that comes up with this scheme is what effect it has on the power-factor? A number of machines arranged this way have been designed and placed in operation. With these machines the power-factor can be held constant at all loads, yet all the range in voltage desired can be obtained.

6. Since this method was proposed, another and still simpler method has been brought out. This scheme was proposed by J. L. Burnham. Instead of making each pole with three sections and with two windings on each, only two sections are used. On each section only one winding is used. The large section corresponds to the main shunt winding on an ordinary synchronous converter, while the regulation is obtained entirely by changing the excitation of the smaller section, exciting it in one direction to boost the voltage, and in the other to lower the voltage.

Anti-hunting devices of many types have been designed and put in operation, most of which have been reasonably successful. The latest, and in many ways the most efficient form of bridge, is formed

by placing some copper rods directly through the face of the pole tips, although completely surrounded by the magnetic material. These copper rods are all joined together by heavy copper rings, thus forming a complete squirrel-cage winding similar to that used on the rotor of an induction motor.

These rods, being placed directly through the pole-face, are naturally in the main flux and consequently form very efficient dampers.

Nothing has been said as yet about transformer connections to be used with synchronous converters. There are many conditions existing in different parts of the country which have made it advisable to use some special form of connection for the transformers, but the general practice is to use the diametrical connection with all six-phase machines. This connection is particularly useful in lighting work as it provides a ready means for obtaining a neutral. With three-phase converters the transformers are usually connected in delta. In many cases they are connected in Y to obtain a neutral, which can be done if special provision is made in distributing the windings in the transformers.

First of Pennsylvania Railroad Tunnels Completed.

The first of the four tunnels which the Pennsylvania Railroad is building under the North and East rivers was completed on the morning of Friday, February 21, when one of the tubes under the East River was connected. A party of engineers walked through the tunnel from the Manhattan end, and the announcement was made that official ceremonies incidental to the completion of the tube would be held shortly. It is stated that trains may be running from New Jersey to Long Island within two years. The two North River bores were practically finished last year, so that now all that remains before trains may be operated from New Jersey to Long Island is to open the East River tubes.

Bruce Peebles & Company, of Edinburgh, Scotland, in Trouble.

The engineering firm of Bruce Peebles & Company, of Edinburgh, Scotland, has called a meeting of its shareholders for the purpose of arranging a liquidation. The trouble of the firm is attributed to the lack of working capital. The company has immense contracts on hand, notably the great Shanghai dock, and it recently concluded a contract of $10,000,000 for street railway construction in Moscow. The directors of the company hope to find a method of reorganization.

Fair Play for Public Service Corporations.

Milo R. Maltbie, member of the Public Service Commission for the First District, New York, made an address before the University of Cincinnati, on February 20, on "Fair Play for the Public and the Corporations." Mr. Maltbie said, in part:

"The inevitable tendency of public utilities toward monopoly and the futility of competition are now quite generally recognized. There are also fundamental reasons why the present trend will continue. Competition means economic waste. The multiplication of pipes, wires, tracks and other fixtures in the streets means an increased financial outlay, upon which interest and dividends must be earned. One company can supply an area with a given surface at almost one-fifth of the expense for distribution that five companies must charge. Competition also means inconvenience and injury to the public.

"Our experience clearly shows that monopoly control of a public utility is almost certain to be very beneficial to the company, and that it may be productive of good to the user, and to the public generally and to the state. But that it may be does not necessarily indicate that it will be; for the constant tendency of all monopolies is to appropriate as their own all the gains accruing from unified control, to disregard the welfare of the public and to become indifferent to progress and the development of new processes. There are instances of progressive, liberal and efficient management, but the usual trend is distinctly in the opposite direction.

"One of the strongest indictments against present conditions is that public service corporations are often stock-jobbing enterprises, that their securities are sought for speculative rather than for investment purposes. Every one knows personally of instances where great public undertakings have been used merely as pawns in the financial game for the benefit of some speculator. He improved the property and the service if it fitted in with his plans, he let the plant run down and ignored the public if his interests happened to lie in that direction. Some of the greatest scandals of our financial history have been in the manipulation of public utilities.

"The question has another side, for the investor needs protection not only against fraud, dishonesty and misrepresentation in corporate management, but he needs protection from hasty legislation, blackmailing schemes and popular movements based upon class prejudice or misinformation. The public is naturally prone to go from one extreme to another. When it suddenly learns of the rottenness found to exist in some one corporation it assumes that all are corrupt and that all should be punished. In its eagerness to punish the guilty and to prevent the recurrence of the evils, it seizes the nearest weapon and precipitately does something that injures the public itself and does not treat the corporations as a class fairly. The state should set the example of justice and fair dealing. A proper system of governmental supervision will not only protect the public from the corporations but will protect the corporations from the dishonest schemes of unprincipled politicians and hasty legislation.

"These are facts which stockholders and corporation officials should not forget. If the present movement for public control is defeated, if present conditions continue, the time will come when public officials, legislatures and courts will be swept off their feet and such radical measures adopted that great injustice will be done. The people are determined to have their rights, and if they are not obtained in an orderly, fair way they will take them by force. Yet the public believes in fair dealing, and if the problem is placed squarely before them they will support whatever solution is fair to them and fair to the corporations.

"Under a proper system of governmental supervision those franchises which have been so immensely valuable will become of little value, for any corporation which operates under them will be required to give such good service at so low a figure that all above a reasonable profit will go, not into the pockets of the stockholders or the stock manipulators, but into the hands of the public, either through improved service or lower charges. There will then be no huge financial stake to play for in the game of politics and opportunity will be given for the political parties to devote their attention to questions of statecraft and to the improvement of public welfare."

March Meeting of the American Society of Mechanical Engineers.

The March meeting of the American Society of Mechanical Engineers will be held on Tuesday evening, March 10, at 8.15 o'clock, in the Engineering Societies Building.

The meeting will be addressed by Dr. Charles P. Steinmetz, the subject being "The Steam Path of the Steam Turbine."

The Opening of the Hudson River Tunnel System.

The first of the Hudson & Manhattan Railroad Company's tunnels under the Hudson River was opened to the public February 25. This part of the route consists of a twin-tube tunnel extending from Hoboken, N. J., to Sixth avenue and Nineteenth street, New York, a distance of nearly three miles. This section of the tunnel system is generally designated as the Morton street, or uptown, tubes.

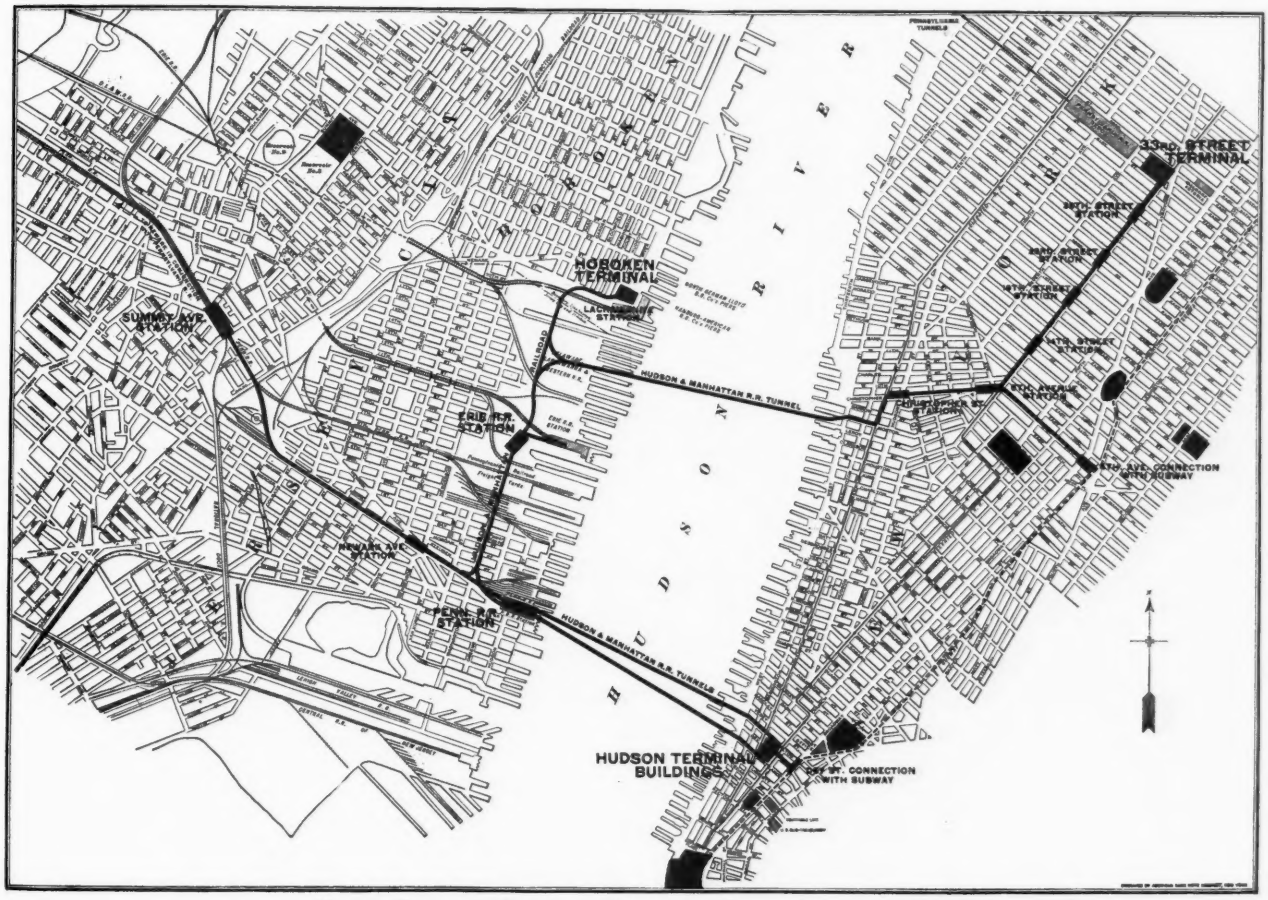
Passenger stations in Manhattan will be located as follows: Christopher and Greenwich streets, where connection will be made with the Ninth avenue elevated line; Christopher street and Sixth avenue, where connection will be made with the Sixth avenue elevated, and in Sixth avenue, at Fourteenth, Nineteenth, Twenty-third, Twenty-eighth and Thirty-third streets. For the present trains will run only to Nineteenth street and Sixth avenue.

At the Hoboken terminal direct connection is made with the Delaware, Lackawana & Western Railroad, where all through and local passengers coming in from the West may get out of the trains and descend directly to the tunnel cars without leaving the station.

Eight-car trains will be run continuously through the tunnel, and the time between Hoboken and Nineteenth street, New York, will be about ten minutes.

The cars are made entirely of steel, fireproof, and are constructed upon a plan differing materially from any others now used in the Metropolitan district. They have large sliding side doors in the middle, as well as at either end, and the platforms are so arranged at the terminal stations that passengers enter and leave the cars at the same time. Those leaving any door in the train remains open the fraction of an inch. The cars are brilliantly lighted and very comfortable. They have only side seats and are equipped with steel rods set vertically at frequent intervals and these aid passengers to steady themselves when trains are crowded.

Throughout the system, which comprises eighteen miles of under-river and underground railroad, the stations are designed with a view to comfort, permanency and beauty. Every part of the stations is constructed either of concrete or metal, so that, like the cars and the tunnel, there is no possibility of fire.



Map of Hudson & Manhattan Railroad—Hudson Tunnel System.

The doors of the cars are operated by compressed air, and no signal bells are used. When the last door in the train is securely closed the motorman receives an electric-flash signal and starts the train. The automatic adjustment is such that the signal to start can not be given so long as

Throughout the system the ventilation will be perfect. In the tubes under the river the atmosphere is always cool, as each train that goes through acts as a piston, forcing the air ahead of it and drawing in a fresh supply from the surface as it proceeds. In the underground section of the system, on either side of the river, the tracks run through tubes the same as under the river, or are separated by centre walls, so that the piston action upon the air is everywhere maintained. Under Sixth avenue a wall is built between the north

and south-bound tracks, so that each train forces the air ahead of it, keeping the tunnel constantly filled with fresh air from the surface. In addition to this the company has installed all along the line apparatus for artificial ventilation which may at once be put into use if, for any reason, the tunnel or stations require an additional supply of fresh air.

All of the stations have wide, easy stairways, so that little effort and no crowding or jostling is experienced going in or coming out. In each of the terminal stations there are separate platforms for those departing and those arriving, so that the two tides of traffic are never in conflict.

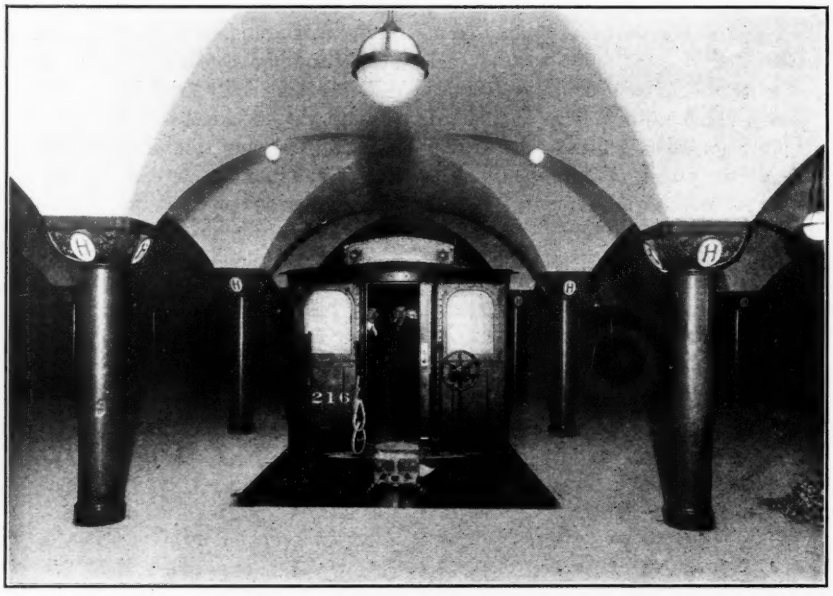
The tunnels in the Hoboken-Manhattan section, like those in all parts of the system, are made of steel rings, bolted together and set in place as the boring shield, working in compressed air opens the way for them. The steel rings, in most places, are covered with a coating of concrete, so that the interior of the tunnel is smooth. The interior diameter of these tubes is fifteen feet and three inches. The depth of the tunnels below the surface of the Hudson River varies from sixty to ninety feet. In the deepest place it is ninety feet from the level of the water to the top of the rails. The depth of earth and rock between the roof of the tunnel and the water ranges from fifteen to forty feet, the deepest part of the river being on the New York side. The two tubes are entirely separate from each other and are about thirty feet apart for the greater part of the distance under the river.

To the person not entirely familiar with the geography of the metropolitan district the new tunnel system may be most clearly described by dividing it into four sections, all of which are connected and also brought into direct connection with other principal transportation lines on both the New York and New Jersey sides of the river.

The first section, so designated because it is the first to be used by the public, is that part of the system just described and generally known as the north tunnels.

The second section is the south tunnels, nearly completed, which extend from Cortlandt and Fulton streets, New York, to Jersey City, where a large terminal station has been hewn out of solid rock directly beneath the present structure of the Pennsylvania Railroad station.

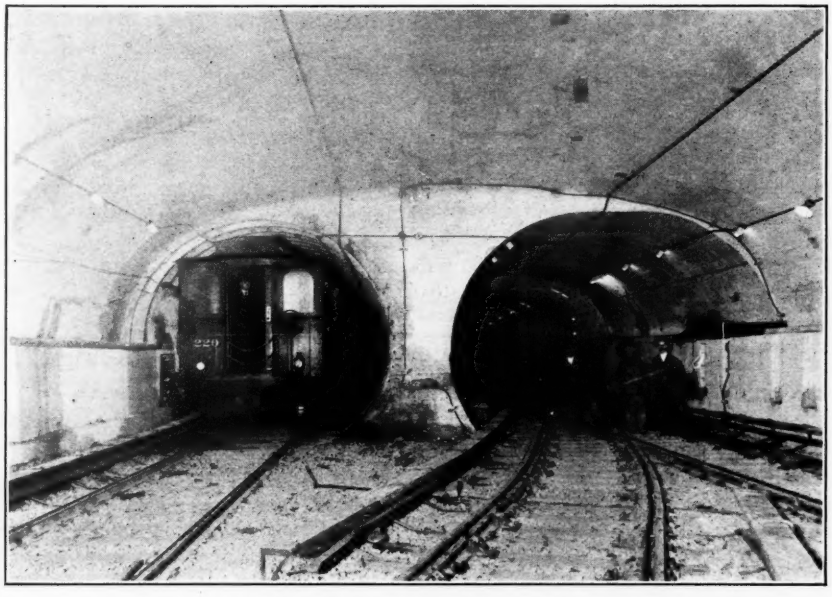
The third section is a transverse tunnel running along the New Jersey shore of the Hudson, one and a fourth miles, connecting the terminal in Jersey City with that in Hoboken. This section is one of the most important of the system because it taps all of the trunk and local transportation lines on the Jersey shore between the two points, and serves as an important feeder to the under-river tubes. The principal point in this line is at the Erie terminal, where the tunnel station is nearer the train shed of the Erie than is the entrance to the Erie ferry.



One of the Track-Ends at the Hoboken, N. J., Station, Hudson River Tunnel System.

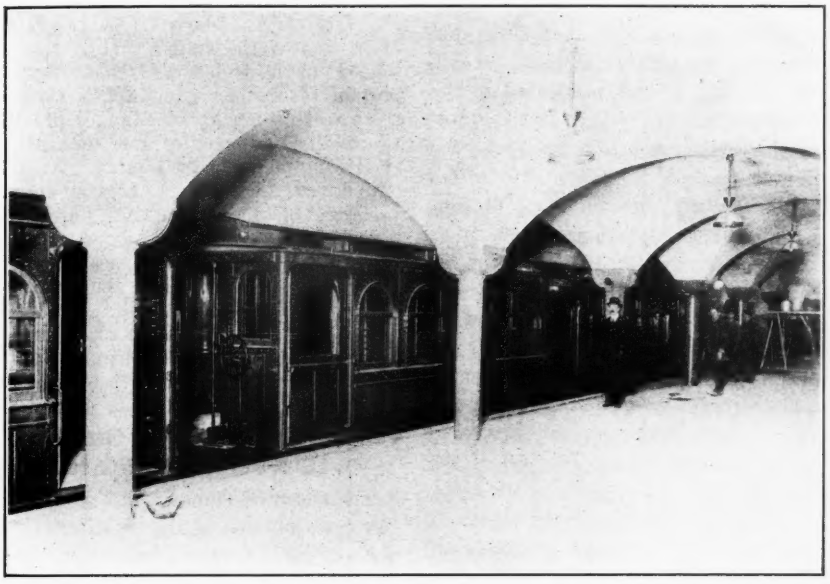
The fourth section of the system is a branch line running from Jersey City to Newark. This extends underground through the populous district of Jersey City and then comes to the surface and continues over the tracks of the Pennsylvania road to Newark. Another spur of the underground system, now being constructed in Manhattan, runs from Sixth avenue, east under Ninth street, and will connect with the Interborough Rapid Transit Company's subway near Astor place.

One of the most interesting and important points in the tunnel system is the great twenty-two-story structure located at Church and Cortlandt streets, known as the Hudson Terminal Buildings. From the train platforms, two stories below the



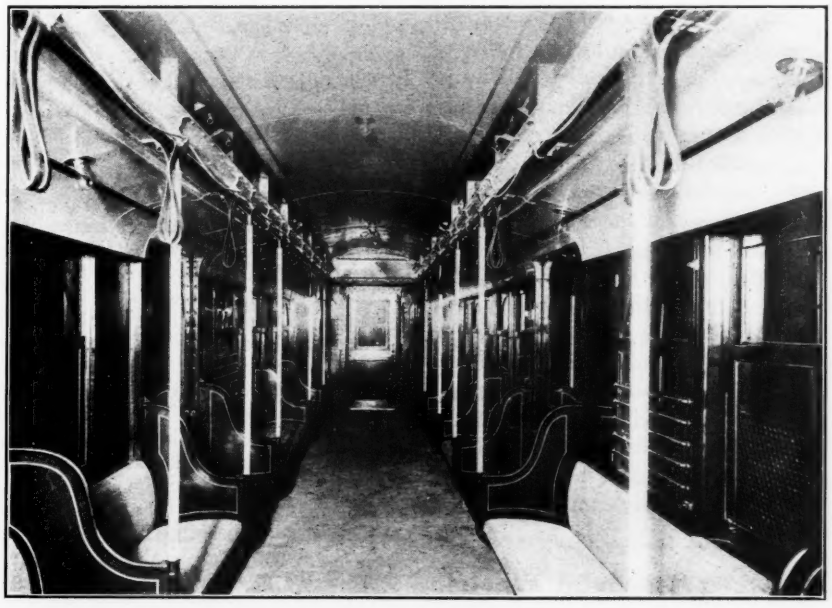
A Cross-Over and Entrance to the Tubes, Hudson River Tunnel System.

street level, one may proceed by underground and under-river routes to any part of Greater New York, and may also make the start on a journey to any point in North America, reached by railroads.



A Station in the Hudson Tunnel System—Showing All Steel Car, with Side and End Doors.

The building will accommodate 10,000 office tenants and will be ready for occupancy on May 1. It is the largest office structure in existence, containing 18,500,000 cubic feet, and more than twenty-five acres of floor space.



Interior of Car Used on Hudson & Manhattan Railroad.

The tunnels come in under the Hudson River and under the great structure about thirty feet below the street level, forming a loop with platforms and approaches of sufficient dimensions to accommodate 1,000 persons a minute, or 500,000 persons during the day. The building has fifty-two elevators and is fireproof.

The project of building a tunnel under the Hudson River had its inception in 1878, when D. C. Haskins, a civil engineer, conceived the idea of constructing a brick tunnel from Hoboken to New York, through which he proposed to run railroad trains, having a grand railroad terminal in the vicinity of Washington Square. His plan embodied simply a tunnel for the purpose of gaining access to New York for a terminal and did not contemplate the extensive system of connecting lines now being completed.

With much difficulty a company was formed to undertake the great work, and after a large sum of money had been spent and about 1,200 feet of tunnel built, the company failed and in 1880 the undertaking was temporarily abandoned.

In 1890 another company was organized with English capital and the contracting firm of Pearson & Son, now engaged in constructing the East River section of the Pennsylvania tunnels, resumed work where the Haskins company had left it.

This company, after adding about 1,800 feet to the part already built, also failed and once more the enterprise was checked. The original tunnel was constructed of brick and masonry, in the old way, but it was the first time compressed air had ever been used in horizontal work of this sort. As far as it went, the tunnel was well constructed, but it was the generally accepted conclusion that, with steam locomotives, the tunnel, if completed, would have been a failure because of the accumulation of smoke and gases. At that time electric motors were not in use.

In 1901 William McAdoo, who came to New York in 1892 to engage in the practice of law, became interested in the project of rapid transit between New York and New Jersey, and organized a company to go on with the tunnel. The 3,500 feet of old tunnel was acquired and the tube finished with the steel-ring method. A second parallel tube was built. These are the tunnels to be opened February 25, but to them has been added the extension under Sixth avenue, on the New York side. By degrees the system was enlarged, other tunnels built, and now the work is nearly finished. The entire system of nearly twenty miles will be in operation during the coming summer.

The men who have been conspicuous in the work are: Walter G. Oakman, president of the construction company, known as the Hudson Companies; William G. McAdoo, president of the Hudson & Manhattan Railroad Company, and Pliny Fisk and William M. Barnum, of the banking firm of Harvey Fisk & Sons. The engineering features were worked out by Charles H. Jacobs, chief engineer, and J. Vipond Davies, deputy chief engineer. During a part of the time since the work began as many as 6,500 men have been employed at one time.

The cost of the system when fully completed will be about $70,000,000.

The company's power-house at First and Washington streets, Jersey City, has been erected and the work of installing the apparatus is approaching completion. The initial installation will include two 3,000-kilowatt and two 6,000-kilowatt Curtis turbines.

The Transmission Lines and Feeders of the New York Central and the Public Service Commission.

The New York Central & Hudson River Railroad Company has submitted to the Public Service Commission its answer to the petition of John H. O'Brien, commissioner of water supply, gas and electricity, of January 23, asking that the commission compel the railroad company to remove its overhead high-tension transmission pole line and conductors erected along the right of way from a point north of McComb's Dam Bridge along the Harlem River, the Harlem Ship Canal and the Hudson River to the city line. The answer denies most of the allegations in O'Brien's petition and asks that the petition be dismissed.

Commissioner O'Brien's petition alleged that on June 9, 1906, William B. Ellison, then commissioner of water supply, gas and electricity, issued a permit to the company to electrify its road and that this permit, which was accepted by the company, contained the following provision:

"Nothing in this permit shall be construed as allowing or authorizing the erection, construction, maintenance and operation of a pole line, overhead transmission conductors or feeder conductors along the tracks or over any part of the territory embraced within the limits of the city of New York."

The petition also alleged that in spite of this provision the company had constructed and is now maintaining such an overhead high-tension transmission pole line. The answer of the railroad company denies the allegation of the petition that the commissioner of water supply "has cognizance and control of the use and transmission of electricity for all purposes within the limits of the city of New York, and of the construction therein of electrical mains, conduits, conductors, subways and of the erection of poles for the transmission of electricity." The company alleges that "the extent of the authority, if any, of the said commissioner of water supply, gas and electricity in the premises is purely a question of law, and that the determination of such question is not within the scope of the powers conferred upon the Public Service Commission by the Public Service Commissions Law."

The answer recites that under an agreement with the city, according to the laws of 1903, it was incumbent upon the company to complete the electrification of its road and to cease the use of steam as a motive power prior to July 1, 1908, and that therefore the company had to use the utmost diligence in completing its preparation for electrical operation.

The answer also alleges that although its plans were submitted to the department of water supply, gas and electricity on August 24, 1905, action on the application was not taken until June 9, 1906, when the permit mentioned in the O'Brien petition was issued. In the meantime the company, acting upon the belief that it had the right so to do, proceeded openly with the work of constructing the transmission system so as to make it ready for the operation of electrical trains within the time set by law. It is further alleged that by June 9, 1906, when the permit was granted, the transmission lines and conductors connected therewith were substantially erected and nearly completed, and that they were fully completed by July 10 of the same year, that trains were operated by electricity experimentally in the month of July, and that in December, 1906, electrical operation was regularly undertaken.

The company denies the allegation that the overhead high-tension pole lines are now maintained and operated without legal authority and in violation of law, as alleged in the petition, and further alleges that the city of New York permits the maintenance and operation of similar high-tension lines by the Long Island Railroad in the Borough of Queens, and allows the maintenance and operation of much more dangerous electrical transmission lines in the trolley wires maintained in the boroughs of Bronx, Queens, Brooklyn and Richmond.

The answer also alleges that the overhead pole system of the New York Central is the safest and best means of transmitting electric power, and that the danger from short-circuiting is minimized by an automatic circuit-breaking device, which breaks the current at the power-house the instant a short-circuit is established. It also declares that since the overhead transmission lines have been operated experience has shown that they are free from ordinary danger.

Extensive Maryland Electric Road.

It is announced that application is to be made to the Maryland legislature for a charter authorizing the building of a system of electric railroads through the eastern shore counties of Maryland, with a satisfactory connection to Baltimore. The road proper will start at Stevensville, on Kent Island, going straight east for about fifteen miles, where a slight detour of the main line is made to reach Easton. From this point the road will run through Salisbury and important towns in Talbot, Dorchester and Wicomico counties. The road then goes through Pocomoke City to the Virginia boundary. This covers the main line of the system. It is also intended to have branches reaching important places off the main line. One of these will go north, touching Centreville, Churchill, Sudlersville, and terminating at Millington, in Kent County. Another branch of the system begins at the junction of the main line, and this branch will go to Denton. Another branch is proposed from Salisbury to Ocean City, and one from the main line below Salisbury to Snow Hill. The length of the road and its branches will be 190 miles. The country to be traversed has an estimated population of 180,000.

Public Service Act Sustained in New York State.

The Court of Appeals, in the Saratoga Gas case, has upheld the constitutionality of the Public Service Commission law in New York State. The appeal hinges on the right of the legislature to delegate its power to fix rates for gas and electricity, thus affecting the Public Service Commission. The court held that a statute like the one considered, to be valid, confers equal rights upon both parties—both the consumer and the company. The opinion is by Chief Judge Cullen, and the judges all concur. In the course of the opinion Judge Cullen says:

"We see no reason why such power should be denied the legislature. The enormous pecuniary interest involved and the inherent difficulties of the problem would doubtless dictate great caution and mature deliberation in enacting any legislation on the subject, but it seems to me that it should equally dictate that the legislation should provide the most practicable, just and efficient solution of the problem. These considerations also apply to the case before us.

"It is plain that no uniform rate of charges could be established that would be just or reasonable. To do this properly would involve an investigation of the particular facts in each case. It has become impracticable for the legislature to discharge that duty. The most appropriate method, speaking from a practical, not necessarily constitutional point of view, is the creation of a commission or body of experts to determine the particular rates."

The effect of the decision is that while the law's validity is substantially upheld, the particular rate for gas and electricity fixed for Saratoga is set aside because the law in this connection does not give the companies an equal right with the consumers to complain.

The Annual Dinner of the American Institute of Electrical Engineers.

THE annual dinner of the American Institute of Electrical Engineers was held in the grand ballroom of the Waldorf-Astoria, New York city, on the evening of February 19. At seven o'clock there was held in the famous Astor Gallery a reception by the president of the Institute, Henry Gordon Stott, and Mrs. Stott, assisted by Mr. and Mrs. Ralph W. Pope, Mr. and Mrs. J. J. Carty, Dr. and Mrs. Schuyler Skaats Wheeler, W. C. L. Eglin and Miss Jane Eglin, Mr. and Mrs. Charles L. Edgar, Mr. and Mrs. Percy H. Thomas. Promptly at eight o'clock the bugle announced all ready for dinner and the receiving line formed and marched to the banquet room, headed by the officers and guests of honor. Other dinners have been marked by especially attractive setting, but it was the unanimous opinion that never before had the grand ballroom been so effectively and attractively decorated. The head table, at which were seated the guests of honor, was ranged along the entire end of the banquet room with the Stars and Stripes, and a great Institute shield in purple and gold for a background. In the centre and flanking each end of the head table was a beautifully illuminated electric fountain, and instead of the conventional candelabra the individual table lamps comprised a number of handsome electric stands with magnificent art-glass domes. Around the base of the lamps were clusters of smilax, interspersed with tiny incandescent lamps, and the entire apron of the table was festooned with smilax and twinkling lights. There were over three hundred present and the tables were arranged for parties of eight, each being set with an art-glass dome and bunch of smilax, with its tiny lamps, and the favors were made up of carnations and American Beauty roses. The sorbet was served in fancy boxes bearing the shield of the Institute, and every one present received a scarf or shawl pin in the form of a miniature incandescent lamp. An excellent orchestra held concert in the gallery overlooking the dining room, and a quartette of male voices rendered selections from the popular musical comedies of the day. The decorations were due to the generosity of the New York, Chicago, Boston, Philadelphia and Brooklyn Edison companies, the art-glass fixtures were lent by Sibley & Pitman, of the Amboy Works, and the scarf pins and miniature lamps for the decorative lighting were contributed by the General Electric Company.

At nine-thirty President Stott, who was also toastmaster, introduced the subject for discussion, and stated that this function had been designated as the "Public-Service Dinner," as exemplifying the relation of the electrical engineer to public service. He sketched briefly the development of public service in connection with the broader aspects of the arts and sciences, and showed how in the evolution of a broader sympathy among men the unrestrained privilege of the individual was now being curtailed and almost everything was passing under state control. He read a letter from Charles E. Hughes, governor of the state of New York, who regretted his inability to be present, and, indicating the broadening scope and increasing influence of the Institute, stated that a letter had been received that day from the President of the United States inviting the president of the Institute to be present at a conference at the White House to consider the conservation of the natural resources of the country.

The president then called upon Walter C. Kerr, president of Westinghouse, Church, Kerr & Company, to respond to the toast "The Ethics of Public Service." Mr. Kerr introduced his subject with many anecdotes and witty references pointing to some of the fallacies of the attitude of the public mind to the subject. Continuing, he said, in part:

"The ethics of this whole subject is merely to be right. Public service is essentially a monopoly, and thus ethics must be based to a considerable extent on this premise. We may talk about competition all that we please, but in the last analysis it will be found that the evils of competition are as a rule greater than their benefits. For this reason we permit by franchise only a limited competition, and often we permit too much. Competition is a panacea to which the ignorant fly for help.

"We have theoretical ethics and practical ethics. The theoretical relate to the exact measures of right and wrong; the practical relate to the possible and the impossible.

"It is fallacious to undertake to do many a thing merely because it is right, when it obviously can not be practically accomplished. In purely mental or academic problems, it is very well to say that 'When at first you don't succeed, try, try again,' but in physical problems a definite, practical outcome must be accomplished with precision and not by trying again, which would only produce chaos.

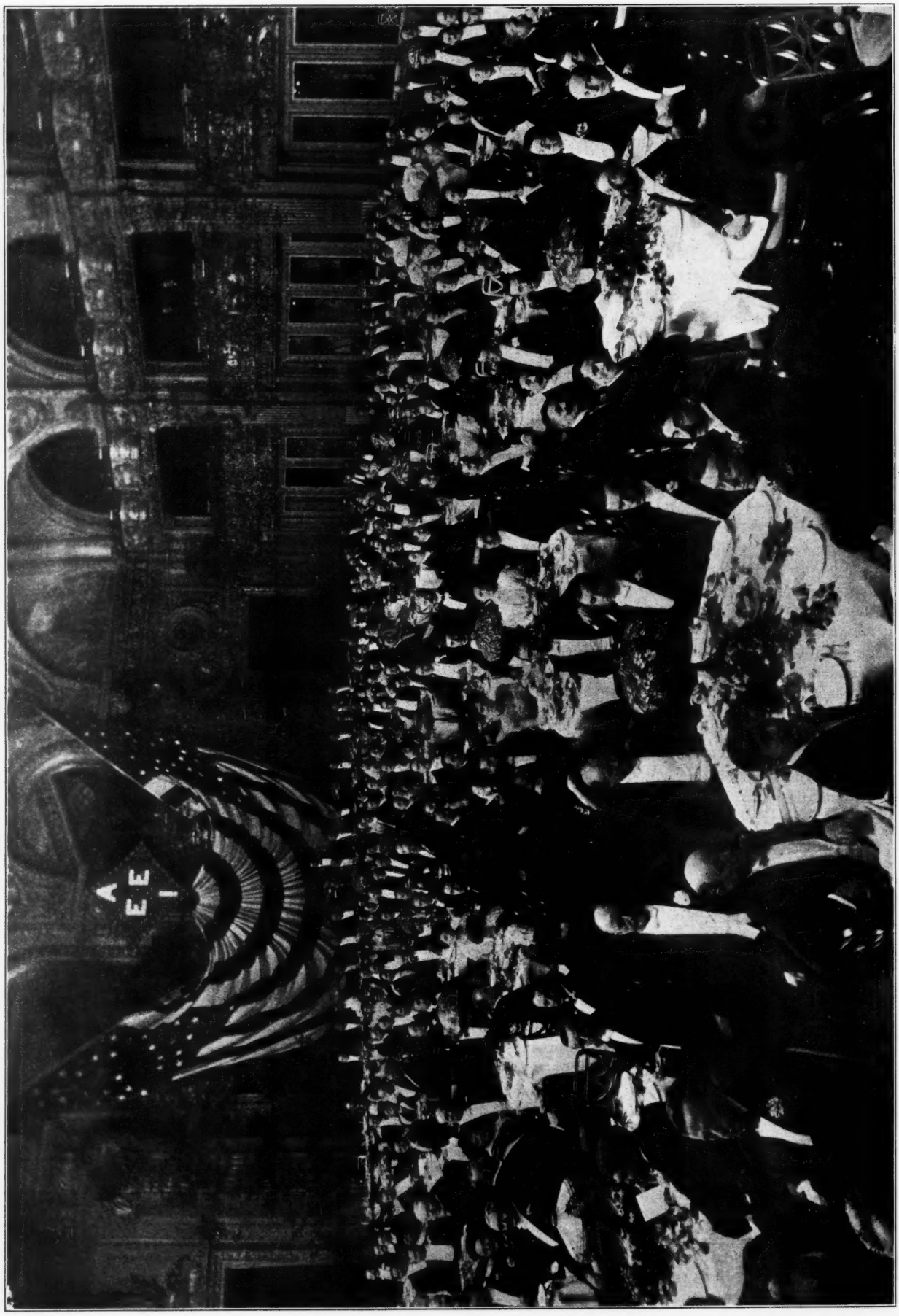
"Successful public service and good ethics need more practical effectiveness and less word painting than their critics supply. Public service is the public's service. It is and will be as good as the public demand; not necessarily as good as they talk about.

"The real demand of the public is voiced not in words but in patronage, in willingness to pay the fair price which includes a profit, reasonable patience which realizes that 'Rome was not built in a day,' disposition to go to the root of causes and not condemn corporations for the sins of the city fathers, or the lapses in state or national governments. I repeat that it is not in words that the public voices its real demands, but more profoundly and more accurately. It is, therefore, these demands without words that the officers of public-serving corporations have to interpret. Ethically, therefore, the public server listens to the voice which rings true if he would properly render service, and not to the vain repetitions of the impractical harangues that so often lead to the impression that a deaf ear is turned to public clamor.

"The public server must be compelled to serve well. The strongest impelling force is the hope of gain. Fortunately, bad service never pays in the long run and good service stands a fair chance of profit.

"If mistakes have been made—and there are many in a developing art—their cost must eventually fall upon the public, and it matters little whether the cost be direct or indirect. As a learned judge once said: 'The cost of error in articles of manufacture must be distributed over the public, for were it not we would have no manufacturers.' The equity of division of burden over the masses is too well known to need defense. What each man seems to want is not to have his share too visible as it comes to him.

"Passing by all details and all differences of opinion as regards ethics in public service, that thing which most cultivated will do the most good is 'The Spirit of Service.' This is one of the weakest elements in the development of



"Public Service Dinner" of the American Institute of Electrical Engineers, Grand Ballroom of the Waldorf-Astoria, New York City, February 19, 1908.

a great, hurrying, progressive community. The spirit of service is unselfishly doing something that does some one else good. It always pays, and when this spirit is sufficiently cultivated, then those who wish to yield public service will be given full, fair and right opportunities to do it. They will then render in the spirit of service, and what they render will be appreciatively received. This is a millennium thought, but it is the spirit of service which makes ethics and public service."

The next toast was on the subject of "The Electric Railways and the Public," which was to have been responded to by Theodore P. Shonts, president of the Interborough-Metropolitan Company. Mr. Shonts had gone to a great deal of trouble in preparing his speech, but he had been subjected to a great deal of strain recently, from many causes, and was indisposed and unable to be present.

The toast, "State Control of the Public Service Corporations, Past and Present," was responded to by Frank W. Stevens, chairman of the Public Service Commission for the Second District (or up-state) of the state of New York.

Mr. Stevens dealt very interestingly with the historical viewpoint of public-service regulation, but confined his analysis of the subject principally to those matters which appertained to steam railroads in the state of New York. Public service corporations and methods of developing and controlling them in New York state have been confined to the last eighty years. He divided the history of state control of railroads into four great periods: The first period, from 1826 until between 1848 and 1850; the second period, from 1850 until 1883; the third period, from 1883 until 1907; and the fourth period, from July 1, 1907, down to the present time. During the first period there were no general corporations laws, authorization being secured by direct act of the legislature in every case. There was no experience upon which to base state control, and Mr. Stevens cited many of the absurd restrictions under which the early steam railroads operated. In the charter of the Mohawk & Hudson Railroad this clause appeared: "That at no time during the existence of this corporation the tolls and charges thus fixed, regulated and received for transportation shall exceed the amount of the tolls and duties, together with the charges of freight to which the property is subjected, the cost of transportation on the Erie Canal at or before the passing of this act." In other words the railroads were to be held down to transporting property as cheaply as canal transportation. The Geneva & Canandaigua Railroad, in its charter of 1828, was authorized "to collect from all persons using or traveling upon said railroad such tolls not exceeding in the aggregate fourteen per cent upon the capital stock, as may be reasonable and necessary." There was no provision as to what they should do after they had collected this fourteen per cent. The charter of the New York & Erie Railroad, the predecessor, far removed, of the present Erie system, in its charter, passed in 1832, was forbidden to "at any point connect the said single, double or treble railroad or ways with any railroad of the state of Pennsylvania or New Jersey, or leading into either of the said two states, without the consent of the legislature of this state, on pain of forfeiting the powers and privileges conferred by this Act." The first general law covering the incorporation of railroads in the state of New York was passed in 1848, and was in many respects like the general railroad law of 1850, but they were not quite ready to invest the power of eminent domain in the railroads. This lasted until 1850, when the general railroad law of the state of New York was enacted which has existed with certain modifications and amendments until the present time. This general law sought to give the fullest freedom for competition, as the experience of mankind had not developed essential monopolies, and it was believed that every problem of managing the railroads would be solved by giving full play to the spirit of competition. Continuing, Mr. Stevens said:

"Whether that system of dealing with corporations will succeed or not can be ascertained by viewing their history in the state of New York during the subsequent thirty years and the experience which was had in this state, demonstrating that it did not work to the advantage of the public and that the evils connected with the system were simply enormous and unendurable. Competition could not exist upon railroads. It may exist between one or two competing points, but the greater number of the places on a railroad are non-competitive, and the result was that competition excited destructive competition between the railroads and the ruin of the railroads themselves so far as the competing points are concerned. The losses upon the business to competitive points were attempted to be recouped by excessive charges on business arising at non-competitive points. In addition to that, the absolute lack of control of capitalization permitted stock schemers and stock jobbers to over-capitalize the roads, and the railroads were wrecked by this bad control of them and the stockholders lost their money over and over again.

"I need not dwell on this history, but simply allude to it, and it culminated in such a state of affairs, such a discrimination, against which the public had no recourse whatsoever, that in the 70's the Granger agitation in the West occurred, and the Granger laws of the early 70's were passed in various parts of the country, and the state of New York had an extensive investigation by its legislature, called the Hepburn investigation, because A. B. Hepburn was the chairman of the committee, and that resulted in the establishment finally in 1883 of the Railroad Commission, and the period of entire freedom was over then and there forever.

"Now, when the commission of 1883 was established in this state, it was made chiefly an advisory commission. It was not given any powers except in a few particulars. It was not able to control—it could suggest, advise and sometimes apply to the attorney-general and bring an action in court. It was organized, the people, believed, upon a wrong basis, and its powers were extended from time to time, so that after the building of the West Shore Railroad, and about 1889 in consequence of the building of that road as a competitor to the New York Central, the power was conferred upon the commission to say whether or not a new railroad corporation should exist; in other words, there could be no railroad corporation organized to operate a railroad without a certificate of public convenience and necessity. Then, again, the powers of the commission were enlarged in regard to the elimination of grade crossings and a variety of similar matters, but the general opinion of the people was that there was not sufficient power in the commission—that the matters which needed regulating by something outside the railroads were so numerous and great that there must be a power adequate to deal with them, and it was this consideration, which I can not enlarge on, but can only briefly advert to, which led to the passage of the Public Service Commission law and which took effect on July 1 last.

"Granting that the public service corporations should be controlled and regulated, in one particular or many, the question arises at once: Can it be done effectually by the legislature? Now, it can not be done—everybody agrees to that—the legislature is not organized to inves-

tigate individual questions. It meets for the purpose of passing general acts, and must trust to some other power to enforce these acts, while the regulation of public service corporations demands that some one should pay attention to the business every minute, and investigate and remedy specific troubles wherever they may require correction. So it was determined that the powers of regulation should be conferred upon the commission. Now, there was a legal question which arose as to whether these powers of regulation were legislative powers or not, and the constitution of the state of New York lays down what is a fundamental proposition in American law—that the legislative power shall be vested in the legislature and the legislature can not delegate legislative power except in such manner and under such circumstances as it may be authorized to do by the constitution, and so it was claimed that the rate-making power, for instance, was the legislative power and that power could not be delegated any more than the legislature could delegate to the commission the power to say that such and such a thing should be a crime, or any other act which is purely legislative in its character. That question has been under discussion throughout the United States ever since 1876. It has been before the courts one way and another a variety of times; it has been contested bitterly, and it has recently been decided in this state, and the decision so far as this state is concerned as to whether the exercise of its powers is legislative or administrative has been settled by the Court of Appeals this week in favor of the proposition that these powers can be exercised by a commission, including the law-making power, and that is now the law of the state beyond any question, according to the decision this week.

"What is the principle which underlies this legislation? Everything relating to governmental matters should be supported on just principles, and what is the principle which justifies a commission, which justifies this public regulation? It is just the same principle which justifies every law which is passed by the legislature, which is in any manner enacted for our guidance and control. Everything that an individual has, from his pocketbook to his life, is absolutely at the control of the public whenever the public demands it. The public does not hesitate to take a man's life. It simply demands that there shall be an adequate cause for it and it regulates carefully the procedure by which that life shall be taken. The public takes a man's property unhesitatingly, as you have discovered when you pay your taxes. It simply regulates the procedure by which that property is taken and the reason for which it shall be taken. There is nothing, absolutely, under our system of jurisprudence, and it could not well be otherwise, to which a man has an absolute right, which he can hold and call his own, which can not be taken from him, from his life down, when the public believes that it is necessary, and that the interests of organized society are best subserved by taking that away from him. That is the principle. It is the principle of legislation, and the principle upon which society and law are organized in this country. Whenever the public, the organized society of the land, discovers a thing is injurious to it, in the long run it is bound as a matter of self-preservation to end that thing in a decent and orderly way, without violence, but it will sooner or later stop it and end it if it can find the way to do it, and so the control of public corporations depends upon just this principle and this alone; whatever the corporations do if left uncontrolled, which is wrong, must be stopped, and those measures must be adopted which will best stop these things and eradicate these evils.

"It is not designed by public service laws to make the members of the commission a board of directors to manage the business of a corporation. It would be futile to try it. In the Second District of this state there are between six hundred and seven hundred corporations subject to the supervision and jurisdiction of the commission. We represent a population in our district of between four and five millions, and they represent a capitalization, all told, of about $2,500,000,000. A board, whether composed of five men or fifty men, could not undertake to regulate all these different corporations. All they can do, and all they ought to try to do, is to cut off excresences, remove evils and abuses, and being created for the purpose of stopping abuses, to create no abuses themselves; being created to stop injustice, they do no injustice, but to be eminently fair to everybody and to secure a fair deal and equal rights to all mankind under their supervision."

Charles R. Huntley, president of the Buffalo (N.Y.) General Electric Company, responded to the toast, "The Electric Lighting Companies and the Public." Mr. Huntley said:

"I am especially pleased to know that the chairman of the Public Service Commission of the Second District is a guest of honor with such distinguished associates. His presence not only attests the existence and activity of the commission of which he is chairman, but reminds me also that what I proposed and earnestly advocated as long ago as 1895 at last has come to pass. Not that I would arrogate to myself the glory of creating this commission. Far from it. But years ago I saw the need for it, saw it from the viewpoint of the electric companies as well as from the standpoint of the people. I suggested and urged at that time the creation of a commission in this state similar to the Massachusetts commission, which has accomplished so much for our neighboring commonwealth and has been a benefit alike to the companies and to the people. The suggestion went unheeded then, but I am delighted to see its realization now.

"The subject allotted to me to-night affords excellent opportunity to demonstrate my meaning. Around the business of electricity or electrical development hovers an air of mystery in the public mind. It may have had its inception in the magic or miracle by which invisible energy is developed, harnessed and utilized. But whatever the reason the fact remains that the popular idea surrounds electrical industry with mystery and regards electrical energy as a creation without cost rather than as a product manufactured under permanent fixed charges and expense.

"It seems to me the sooner this erroneous idea is banished the better. The electric company is a manufacturer precisely as a company that makes any other commodity. It does not have its product to stand on shelves in a store or carry around the country in job lots or sample cases—for its product is invisible until applied, and even then the result of the product alone may be seen by the eye. An electric company builds its plant, installs its machinery, buys its coal, lights its fires, and manufactures its product just as any other manufacturing industry does. It manufactures watts of energy as another manufacturer makes pairs of shoes or sewing machines or textile fabrics. It has a first cost of production just as any other manufacturing business. Its plant is subject to depreciation, to wear and tear and to the necessity of keeping pace with the latest development and invention.

"An electric company handles a perishable product. Improperly handled it dissipates into nothingness. This commodity represents a cost that can not be merged into mystery or ignored by a mere erroneous idea of magic. The fact that

it is a public service company brings upon the manufacturer criticism far beyond that of any private company. It is expected to please all of the people all of the time —whereas all of the people never are of one mind at any time. It is subjected to sincere and insincere opposition and finds among its critics not only the unwise but the overwise.

"I believe our people are fair and when they understand the facts they do not willingly work harsh injustice. The danger lies in the lack of knowing the facts. Ignorant criticism, no matter how sincere it may be, is futile. The public, not knowing the full esential details, may have come to look askance at many public service companies. The companies in turn may have been more reticent and reluctant to discuss the details of their business in the face of suspicious or hostile, malicious criticism.

"Right here is where the Public Service Commission steps into the breach. On the one hand it can learn the details of the business of electric companies. It can get absolute facts. It can point out any conditions requiring remedy or improvement, and require such to be made. It can ascertain for itself the cost of manufacturing the energy which these companies market in the business of electric distribution. It can see at first hand the items of plant, maintenance, distribution, operation, depreciation, obsolescence and taxation. It can invoke the aid of those who are well equipped technically in the art and reinforced by years of experience. All this it can do on the electric companies' part. On the other hand it can tell the people just what the facts are, it can dispel erroneous ideas in the public mind and correct mistaken notions in the popular viewpoint. It can work exact justice, protecting the people from any injustice on the part of the companies, and protecting the companies from any wrongful criticism, misguided clamor or gross injustice on the part of the people.

"With this knowledge at hand, gradually the manufacturer and the consumer —the electric company and the citizen— will come to mutually understand the full facts, and when that is done I am confident that most of the troubles that now harass any electric company will be at an end.

"Yielding to unjust clamor, due to failure to know the facts or to a deliberate disregard of them, will not hasten the day; but patient perseverance along the lines of duty, observing the highest standards of business ethics, and with faithful regard to the rights of investors and the interests of the people, will aid immensely in the work.

"We should educate the people to the possibilities of the companies' product. Energy is the essence of modern development. Power is the most potent factor in the whole world of industry and toil today. It is man's substitute, won from the realms of mystery to do the labor of his hands, to light his streets, to light his home, to run his mills, to operate his trolley cars, to print his newspapers, to turn the wheels of industry—in short to lift from off his shoulders the load of toil and in its own invisible might perform the tasks of mankind so far as power and strength and ertia are able to do. Whether it springs from a cataract or from a coal mine, it costs from the moment its production begins, and it costs throughout its transmission until it dies away with its labor done.

"Therefore, let us diffuse not only electric power and light for public places and private homes, but let us also diffuse educative light in the popular mind and the intellect of the individual. Ignorance is mental darkness. Knowledge is not only power but light. 'Let there be light' is a motto as old as the world and with a significance as new as the latest thought uttered here to-night. For the blackest darkness in history has yielded to a ray of light and the future of electric companies will brighten precisely as the darkness of popular ignorance yields to the light of a common-sense knowledge founded upon a full possession of the facts."

The toast "The Technical Press and the Public" was responded to by T. Commerford Martin, who said, in part:

"The technical journal has but one aim, but one commission, in life, and that is to cultivate the truth and to give the facts, and it serves the interests of both its public and the public by telling its public how to improve its service to the other public. I regard it as a great injustice and a great misfortune that the technical press can not reach a larger proportion of the greater public in order to correct the injury that is thus done to the public utility corporations, and more particularly to the technical staffs which serve them and which underlie their every operation. Discontent is fostered with our methods, our motives and our apparatus, and discontent is focused in every possible manner upon the accidental poor working of five minutes in the twenty-four hours and the utter disregard of loyal, faithful, self-devoted, sacrificing service during the other twenty-three hours and fifty-five minutes."

President Stott announced that Dr. Charles P. Steinmetz, who was to have responded to the toast, "The Engineer and the Public," was indisposed and unable to be present. He then called for a vote of thanks to the dinner committee and the companies which had assisted with the decorations and souvenirs, and the "Public-Service Dinner" passed into history.

National Electric Light Association.

A meeting of the executive committee of the National Electric Light Association was held at the office of the association in New York city, on Thursday, February 20. The following members of the committee were present: Dudley Farrand, president; W. C. L. Eglin, first vice-president; Arthur Williams, Charles L. Edgar, Charles R. Huntley, Louis A. Ferguson, Frank M. Tait, A. J. DeCamp, and W. W. Freeman, secretary. The details of the Chicago meeting were taken up and decided upon. Frank H. Gale and Walter Neumuller, chairman and secretary, respectively, of the exhibition committee, presented the plans of that committee, which were approved. A number of important matters bearing upon the work of the association were considered, and satisfaction was expressed regarding the progress made in various ways since the last meeting. Applications for membership from thirty Class A members and twenty-three Class B members were approved.

The Nebraska Electrical Association.

At a meeting of the executive committee of the Nebraska Electrical Association held at Lincoln, Neb., on February 19, it was decided to hold the annual meeting of the association in Omaha on April 15 and 16. This change has been made to bring about the meeting during the week of the Omaha Electrical Show, which is to be held in Omaha, at the Auditorium, from April 13 to April 18. William Bradford, of Lincoln, is secretary of the association, and L. E. Watson, of the Beatrice Electric Company, is chairman of the programme committee.

American Electrochemical Society.

It is announced that the spring meeting of the American Electrochemical Society will be held in Albany, N. Y., on April 30, May 1 and 2. The place selected offers many attractions for a meeting, and the proximity to Troy, Schenectady and some important water power sites offers opportunity for interesting excursions. The programme for this meeting has not yet been prepared.

REVIEWS OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE

Metallic Filaments and Revision of Tariffs.

The conclusion is given here to a somewhat detailed study of the effect of the new high-efficiency lamps on the central station business. It is shown that as these lamps come into general use the output of the station must necessarily be affected. Various plans for compensating for the loss in the station which must result are discussed, the following being the general conclusion. From a table showing the revenues to the gas and electric companies of Great Britain figures are taken which show that the former do about six times as much business as the latter, while there are about eight consumers of gas to one of electricity. The electrical companies of Great Britain are therefore doing only fifteen per cent of the lighting business. If the metallic filament comes in, these companies must do, at the least, fifty per cent of the lighting business. Taking all things into consideration, it is thought that the metallic filament is not a catastrophe for the central station engineer, although it may be for the gas companies. The electrical companies are facing a crisis. They have struggled heroically against gas all these years under a heavy handicap. Now the time has come when the handicap is revised, and it is believed that the electrical companies will get the lighting business. This will, of course, be at the expense of the gas companies, but the latter still have a large scope for increase in the heating and cooking business.—*Abstracted from Electrical Times (London), February* 6.

Inductance Measurements.

Some special arrangements for measuring inductance are discussed here by Albert Campbell. These arrangements are supplementary to a more general paper presented recently before the Physical Society of London. If the unknown self-inductance is less than twice the value of the highest reading of the variable mutual inductance, the method of equal arms is available; but when it is greater than this it is convenient to connect the fixed coils of the variable mutual inductance in one arm of the bridge while the alternating current of the supply is taken through the adjustable coils. For comparing coils of nearly equal self-inductance it is important that they should be placed so that there is no magnetic leakage between them and the standard. This condition is fulfilled in the ordinary Maxwell bridge arrangement. Maxwell's method of comparing two mutual inductances is applicable to a single primary coil having two secondaries. The case is different when there are two separate primary coils. If, however, the positions of galvanometer and the source were interchanged, the formulas for the Maxwell bridge still hold and a satisfactory arrangement is obtained. For measuring capacity a variable mutual inductance standard used in Carey Foster's method is convenient for all capacities and is fairly accurate. For testing the exact equality of mutual inductances, the following devices are useful. The primary coil is made of relatively large diameter, while the secondary consists of another coil outside it in series with a small coil concentric with the others. The addition of a single turn to the winding of a small coil makes such a small change in the inductance that the value can be easily set with accuracy.—*Abstracted from The Electrician (London), February* 7.

Single-Phase Electric Railways.

Although a good deal of information appears from time to time describing the application of the single-phase railway system, nowhere has there appeared a comprehensive statement of what has actually been accomplished. It is to furnish this lapse that M. N. Blakemore has prepared this summary. This shows one of the newer phases of electrical development. In fact, it shows that one company alone has filled orders for more than fifty locomotives, of which considerably more than half were adapted for both alternating and direct current. A table is given showing what installations have already been made, the length of miles electrified, the number and type of equipment and the type of control. This table also includes those roads under construction but not yet in operation. A summary of this shows that twenty-eight roads have been or are being equipped with the single-phase system. The total mileage of these is 966, of which 692 are in operation. (One important road has since been put in service.) The total number of cars for these roads is 240 and the number of locomotives fifty-seven. The total horse-power of these motors is 137,400. This table does not include certain special locomotives, such as the 135-ton locomotive constructed for the Westinghouse Works, and the seventy-ton, fifteen-cycle locomotive which is now being tested by the Pennsylvania Railroad. All of these installations are operated from a single catenary trolley with the exception of the New Haven road. A pantagraph trolley is almost entirely used in this country, although the sliding-bow trolley has been used. This, it is said, is not as satisfactory as the other, as it does not follow so easily the varying heights of the wire. The mileage given in the summary is that of system and not that of the tracks.—*Abstracted from the Electric Journal (Pittsburg), February.*

Vertical-Shaft Motors.

A description is given here of a line of Dutch motors constructed by the Electrotechnische Industries of Slikkerveer, Holland, which are interesting, since they run in a vertical position and make use of ball bearings. The type of design varies somewhat, according to the purpose for which the motor is intended. One motor described, rated at ten horse-power, is a direct-current machine suspended from a ball bearing at the upper end of the shaft and guided by an ordinary sleeve bearing at the lower end, the latter being of peculiar design. This motor is intended for driving a centrifugal pump, to which it is directly connected by a coupling in the lower end of the shaft. The lower bearing is interesting, since it is inverted; that is to say, a sleeve on the motor axle fits over a corresponding sleeve on the motor casing. This has been done in order to enable the bearings to run in oil and yet prevent any oil from getting into the machine. Another motor intended for driving a centrifugal dryer has a ball bearing at the lower end of the shaft; this is

a thrust bearing. The upper end of the shaft is guided also by a ball bearing, this being of the inverted type, thus preventing any oil from getting into the motor. This machine drives through a pulley on the upper end of the shaft. Another motor, rated at sixty horse-power, is designed for driving centrifugal pumps at 900 revolutions a minute. This motor also is provided with ball bearings, the weight being borne by the lower bearing. It drives through the lower end of the shaft. These motors in the shop are generally tested lying on their sides, as this is most convenient. The vertical type has some advantages, and in particular it is convenient for inspecting the commutator and brushes, doors being provided in the casing for this purpose.—*Abstracted from the Electrical Review (London), February 7.*

The Berry Series-Transformer Switch for Saving Light-Load Losses.

A description is given here of a system of distribution devised in order to reduce the no-load transformer losses during hours of light load. In this it is not attempted to save the transformer losses entirely, but during periods of light load a small transformer, with its correspondingly decreased losses, is automatically substituted for the larger transformer necessary to supply the load during average working conditions. The system is due to A. F. Berry, and in brief consists in connecting the primaries and secondaries of the two transformers permanently in series. For example, in a substation a 100-kilowatt transformer is connected in series with a ten-kilowatt transformer, the primaries and secondaries of both being permanently connected. An automatic switch is then installed, controlled by a relay placed in the main circuit, which, when the loading reaches a certain point, short-circuits both the primary and secondary of the smaller transformer, thus throwing it out of service. The ratio of the windings of the large and small transformer is such that when the two are working in series the magnetizing current flowing through the circuit will not carry the induction in the large transformer up to the steep part of the magnetization current, hence the core losses of the large transformer are small, so that practically the only loss occurring is that due to the smaller transformer. As the load comes on, however, the smaller machine is short-circuited so that the necessary magnetizing current may flow through the larger apparatus. The controlling switch is operated by two solenoids, each excited through a switch controlled by the relay in the primary circuit which was mentioned before. A rocking switch is also provided which automatically throws out the relay switch after it has operated. To provide for the contingency which might arise should the small transformer be disabled, a fuse is placed in the circuit of the latter arranged so that when it burns out it will break a silk thread, drop a weight and operate the throw-over switch, thus bringing the larger transformer into service. The system has been tried in several instances abroad, and it was found that the saving was considerable, as was shown in one case by the reduction in the temperature of the transformer substation at Hammersmith, London, the temperature being lowered from ninety-six degrees Fahrenheit to sixty-eight. Similar equipments are now in operation at Croydon, Reading, Scarborough, Wakefield, Bradford, Newcastle and several other places in England.—*Abstracted from Electrical Engineering (London), February.*

Inductance in Parallel Wires.

A problem of considerable importance to the practical engineer or physicist is that of calculating the effective self-induction of a circuit consisting of two parallel wires, one being the return of the other. When the wires are not very close together, says J. W. Nicholson, and the current is either steady or alternating slowly, satisfactory results are given by the following formula: $\frac{L}{l} = 2 \log \frac{c^2}{ab} + \frac{1}{2}(\mu_1 + \mu_2)$, where L is the self-induction of a length l, c the distance between the wires which have radii ab and permeabilities μ_1, μ_2. But if the current oscillates rapidly this formula fails to give even approximately correct results. In many practical problems, such as the measuring of small inductances, it is necessary to employ long leads and keep them at a considerable distance from the bridge and other circuits, and a knowledge of the self-induction in these leads is very desirable. The following expression gives good results if the two wires be of equal radiation: $\frac{L}{l} = 4 \log \frac{c}{a} + \frac{4\mu}{x} \cdot \frac{ber\, x\, ber'\, x - bei\, x\, bei'\, x}{(ber'\, x)^2 + (bei'\, x)^2}$. In this equation $ber\ x$ and $bei\ x$ are the functions introduced by Lord Kelvin. If $\frac{N}{2\pi}$ be the frequency of alternation per second and σ the specific resistance of a wire and μ its permeability, then $x = 2a\sqrt{\frac{\pi \mu n}{\sigma}}$. This formula, passing naturally into the former when the frequency is small, becomes less accurate as the distance between the wires decreases and the frequency or radius of the wire increases. It is subject to an error of not more than one per cent, and the distance between the wires is ten times the radius of the wire and four per cent of the distance is five times the radius of a wire. The error is about ten per cent when the wires are separated by three times their radius. This is usually close enough for experimental purposes. The other sources of error under practical conditions seldom give rise to an error of more than one-tenth per cent.—*Abstracted from Nature (London), January 30.*

Telephone Progress During the Past Year.

A brief review of the telephone progress in Europe during the past year is given by B. S. Cohen in the *Electrician* (London) for February 7. Statistics for the United Kingdom show that the growth there is of a geometrical nature. The National Telephone Company opened 152 new exchanges and bought in five. This company now has over 447,000 telephone stations in Great Britain, showing an increase of about 44,000 over 1906. These stations are connected through 1,437 exchanges. This company has fifty-eight exchanges in London and over 100,000 stations there.

The British Post-Office at the end of March of last year had 41,236 stations in London, making in all over 140,000 instruments in that city.

The National Telephone Company has extended its underground system considerably and has now 1,700 miles of trenches in which are about 350,000 circuit-miles of lead-covered cable. The increase during the past year was 33,000 circuit-miles. This company also rents 40,000 circuit-miles from the British Post-Office.

The measured rate of service is coming into greater favor in Great Britain and other systems of charging are rapidly disappearing. This experience is being shared by other European cities. The measured rate was applied compulsorily in Austria at the commencement of 1907, and although there was some indignation at first, new connections to the system are being rapidly made.

Improved transmission by means of the loaded line is being rapidly introduced. The National Telephone Company of Great Britain has now 581 circuit-miles of trunk junctions constructed in this way. The British Post-Office is also trying the system.

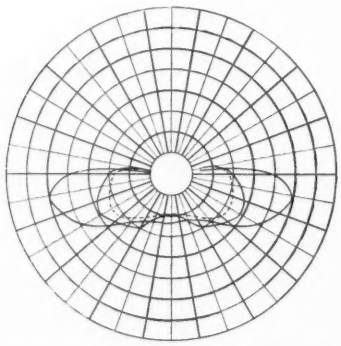
INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

Multiple Luminous Arc Lamps.

The General Electric Company, Schenectady, N. Y., has placed on the market a luminous arc lamp for operation in multiple on direct-current circuits of 100 to 125 volts. This lamp was described in the issue of the ELECTRICAL REVIEW for December 28, 1907.

The upper or positive electrode consists of a drop forging of copper. With a large volume of copper and a large radiating surface it is possible to keep this electrode at a low temperature. This condition, together with the peculiar characteristics of the luminous arc, results in a slow wearing away of the copper. The copper electrode in a four-ampere lamp will require renewal after 1,800 hours' operation, or with an average burning of five hours per day will last about one year. The lower electrode, which is responsible for the flaming characteristic of this lamp, is an iron tube about three-quarters of an inch in diameter filled with a prepared composition. One electrode only is used at each trimming, with a life of about 150 hours.

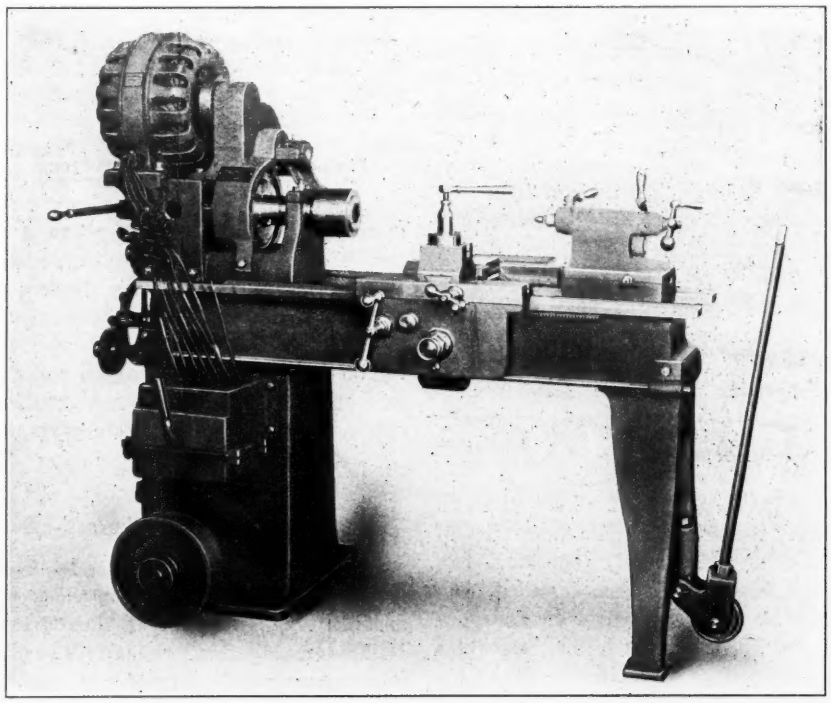


PHOTOMETRIC MEASUREMENT OF SEVERAL ARC LIGHT SOURCES.

The accompanying illustration shows a comparison of photometric measurements of a five-ampere, direct-current enclosed arc; a 7.5-ampere, alternating-current enclosed arc, and a four-ampere magnetite arc. Even with the decreased wattage the increased candle-power, as shown by the outer curve, is noticeable. The characteristic distribution of the luminous arc, with its maximum intensity near the horizontal, is well known. This natural distribution can be changed to meet other street-lighting requirements by the use of correctly designed reflectors.

Westinghouse Motor-Driven Portable Lathe for Locomotive Repair Shops.

The flexibility of electric motor drive has brought into use several types of convenient and labor-saving portable machines. A notable example is the portable bolt-turning lathe designed for use in locomotive repair shops. The illustration shows a lathe made for this purpose by the Williams & Wilson Company, of Montreal, Canada, equipped with a Westinghouse motor. The unit is compact in design and is mounted on wheels. It can be lifted by a crane and placed beside an erecting pit, and then shifted as desired by hand. When in working position the machine rests on the two rear wheels and the front legs. To move it, the legs are lifted from the floor, and the front wheel is brought into contact with it by simply lowering the handle, which acts as a lever.



WESTINGHOUSE MOTOR-DRIVEN PORTABLE LATHE FOR LOCOMOTIVE REPAIR SHOP WORK.

The motor which operates the machine in the illustration is of the well-known Westinghouse induction type, two horsepower, 1,700 revolutions per minute. It is connected through a friction clutch providing for either 200 or 400 revolutions per minute of the spindle. Direct-current motor applications are equally successful.

The current supply is afforded by flexible cable connection to plugs located at convenient intervals. A simple and convenient connecting plug is made for the purpose. The advantage of using a machine of this type in work requiring the turning of each individual bolt to the proper size is readily apparent. It both obviates the necessity of innumerable trips to and from the machine shop and the consequent loss of time, and permits the mechanic to carry on his work without interruption.

When not in use the machine can be moved to a point in the shop where it will be out of the way of the workmen. When not in use for the purpose designed it becomes a valuable and convenient auxiliary to the machine-shop equipment.

Fire in Plant of Electric Cable Company.

Fire in the plant of the Electric Cable Company, Bridgeport, Ct., caused a loss of about $70,000. One of the two buildings of the company was affected. Immediate steps have been taken to restore full facilities.

An Important Telephone Cable Invention.

The increasing use of lead-covered cable by telephone companies all over the United States has brought about a considerable increase in the work required in wiring, by reason of the larger number of taps and splices which are made necessary in underground construction. The taps and splices which are made from the main cables must be protected from the weather and all moisture, and the making of these splices has required the services of men who have a special training to enable them to properly make the splice and wipe the joint. Notwithstanding the careful and conscientious work on the part of the cable splicer, these joints have always been a source of considerable trouble. This fact has stimulated the inventive minds of many telephone cable experts to devise a means for eliminating or at least greatly reducing this trouble.

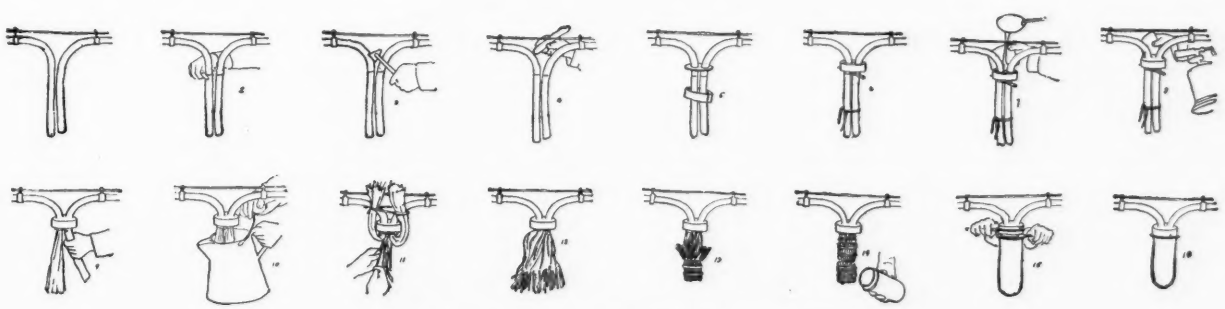
Among other inventions for the purpose is one developed by Luther Hargis and Charles E. Teush, both telephone men of long and varied experience. This invention has been named, after the former, the "Hargis" joint. This joint has been on the market for about two years and has become so popular that it promises to be generally adopted by all cable-using companies.

The process of making a splice with the "Hargis" cable-splicing joint is interesting and may be followed by reference to the sixteen illustrations shown herewith. These illustrations show consecutively the various steps of making up the joint.

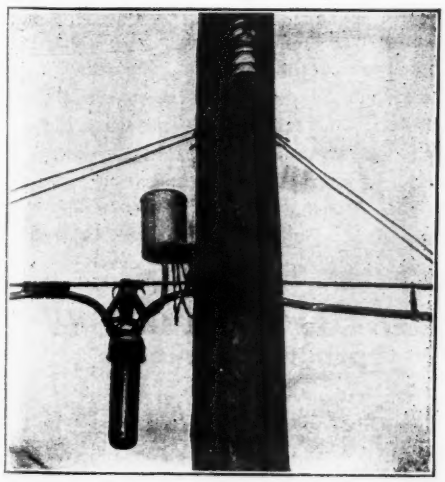
PARTS OF THE "HARGIS" CABLE-SPLICING JOINT AND SPANNERS USED TO OPEN OR SHUT IT TIGHT. COMPLETED JOINT SHOWN ON RIGHT.

The single wiped joint through which the cables enter the splice is of such a nature as to be less subject to faults than are the two wiped joints in a splice constructed by the old method. The wiped joint in the "Hargis" splice is virtually a poured joint, the making of which would seem to be within the skill of any intelligent workman after a little practice. The danger of moisture leaking through the wiped joint on the "Hargis" splice is less than with the two wiped joints of the ordinary splice, and if it should be defectively made and a leak follow, the water would not spread along the cable as it does when a horizontal joint is defective.

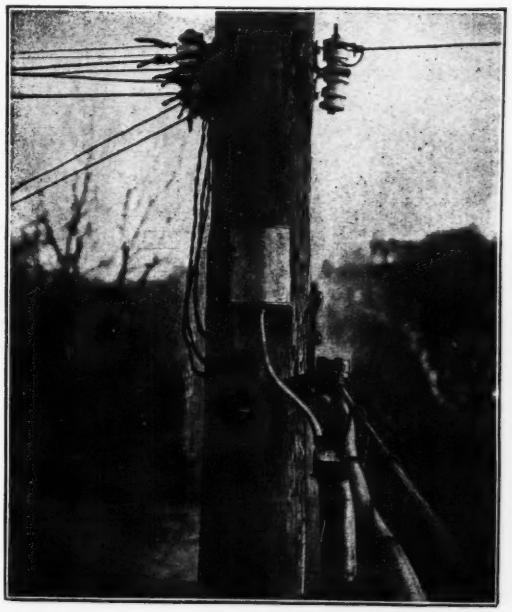
With the use of the "Hargis" joint the conductors in a cable splice are accessible for changes or tests; and it is frequently necessary to open cable splices for the purpose of making tests and locating trouble, or to change the conductor assignment due to changed plans of distribution.



THE MAKING OF A "HARGIS" CABLE-SPLICING JOINT.



THE WAY THE JOINT IS HUNG AND LASHED TO PREVENT A STRAIN ON THE WIRED TOP.



SHOWING JOINT IN MAIN CABLE AND METHOD OF TAKING OUT A BRANCH CABLE.

JOINT OPEN FOR TEST OR CHANGE OF MULTIPLES.

With the "Hargis" joint it is only necessary to unscrew the sleeve, which exposes the cable conductors without in any way altering the wiped joint. Tests made on a splice joining two twenty-five-pair cables and carrying also a fifteen-pair tap cable have shown that the time of changing the conductor assignments of the fifteen-pair tap cable was, with the "Hargis" joint, approximately one-quarter of that required in the joint made in the regular way, and containing similar cables. To this saving in favor of the "Hargis" joint should be added the further saving due to the fact that less material is required in making a change. In the "Hargis" splice the material required would be the paraffine and gasolene necessary to boil out the splice, and perhaps a new rubber gasket. In the regular splice there would be the solder, a greater amount of paraffine and gasolene, and perhaps a new lead sleeve.

This splice has successfully met the requirements of a large number of telephone companies, and the endorsements have been unusually satisfactory. J. M. Plaister, manager of the Fort Dodge Telephone Company, Fort Dodge, Iowa, states that experiments have been conducted with the "Hargis" joint with the greatest care, and that the installation has been very satisfactory. Something over 14,000 feet of cable is arranged in the multiple-tap system, and the company has a feeling of complete security over this lot of cable because of the ready accessibility of all the joints for repair or rearrangement of the taps.

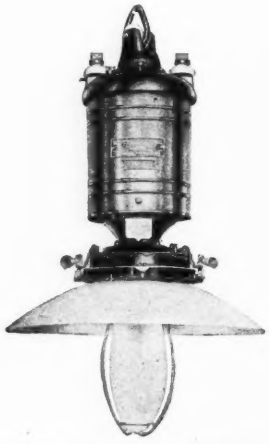
On the point of permanent dryness, C. W. Emmer, manager of the Beaumont Telephone Company, Beaumont, Tex., writing under date of January 28, 1908, says that in at least three manholes the "Hargis" joints are covered with water, and that while one of the joints gave some trouble a short time after being installed, the probability is that it was due to defective installation. There has not been any trouble with the joint since it was repaired. The company intends to subject the joints to the hardest possible tests. In the meantime it has ordered twelve more "Hargis" joints, preparing for the prevention of cable troubles.

The "Hargis" joint is now made in three sizes, and is suitable for use in connection with straight-way and branch splices for all cables from 300-pair down. The combinations for branch splicing are almost unlimited. At the recent electrical show in Chicago the manufacturer had a "Hargis" joint on exhibition which brought a 200-pair cable in and seven twenty-five-pair taps out, leaving twenty-five pair dead for future connections. This illustrated the advantage of using a joint of this kind in a down-town manhole, where it is necessary to radiate tape in all directions from the main cable.

Color Effects of Artificial Illuminants.

Considerable attention is being given at the present time to the selection of just the proper source of illumination that will best meet the requirements for showing colored materials under the most favorable circumstances. Various demonstrations have been made, comparing the illuminating effects of incandescent lamps, both of the carbon-filament and metal-filament types, and in some quarters it is held that while these are very favorable, the light from the enclosed-carbon lamp is superior to any other. In some of these tests no perceptible difference could be noted in the colors of the materials as viewed under the light of the carbon arc and in daylight. Where arc lamps are selected for indoor illumination, difficulty has been experienced sometimes in adapting them because of low ceilings, the length of the lamp making it unsuitable, as the light can not be placed at the point where most desired.

"Hawthorne" Short Arc Lamp.



Arc Lamp with Indicator Drop.

In this connection it is interesting to note how this objection to the use of the enclosed-carbon arc lamp in indoor lighting has been overcome by the Western Electric Company, Chicago, Ill. This company has developed a special type, the "Hawthorne" short arc lamp, for indoor service. This lamp is shown in Fig. 1. The lamp is twenty inches long over all and permits an even distribution of light with very low ceilings. The glassware used is of the same standard size as is used on the longer lamps, permitting the use of both long and short lamps in installations without the necessity of carrying two lines of glassware. The lamp burns 100 hours with one trimming, and the efficiency and utility have not been sacrificed in any way in order to reduce the length.

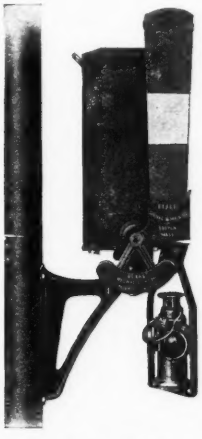
Another feature that has recently been developed by the Western Electric Company in its arc-lamp business is the indicating drop. This feature consists of an indicator which is ordinarily concealed within the case of the lamp, but drops through a slot in the lower part of the case when the lamp requires trimming. This indicator is shown in Fig. 2. It is especially valuable where the lamps are not burned for definite intervals of time and need not be trimmed regularly. Without such an indicator it becomes necessary to inspect the lamps very often in order to insure against failure due to the carbons being consumed. However, with the indicator warning is given before the carbon is totally consumed. It is also economical in the use of carbon, for by this system the carbon will be completely consumed in each case, while with the method of trimming at certain intervals, especially where the lamp operates intermittently, carbons are frequently discarded that would last for several hours longer if allowed to remain.

Receiver for United States Independent Telephone Company.

Justice Nathaniel Foote granted a motion at Rochester, N. Y., on February 17, asking that Henry B. Conklin be appointed receiver for the United States Independent Telephone Company. The sale of the properties of the company's subsidiary company, the Independent Securities Company, was held at Rochester on February 4, and bought in by the bondholders' committee for $400,000. On February 12 application was made at Newark, N. J., to show cause why a receiver should not be appointed.

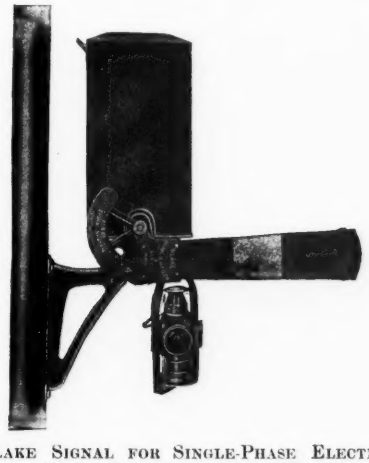
Signals for Single-Phase Electric Roads.

In order to meet the requirements of single-phase electric roads and steam railroads the Blake Signal and Manufacturing Company, Boston, Mass., has developed the type of signal shown in the illustrations herewith. These signals are similar



BLAKE SIGNAL FOR SINGLE-PHASE ELECTRIC AND STEAM ROADS IN "CLEAR" POSITION.

in every detail to the well-known Blake despatcher's signals, for telephone train despatching, now in use on many 500-volt interurban electric roads, excepting the signal light for use after dark. On 500-volt trolley lines the most effective as well as simplest and cheapest method of getting the light for night use was to



BLAKE SIGNAL FOR SINGLE-PHASE ELECTRIC AND STEAM ROADS IN "STOP" POSITION.

connect the 500-volt trolley or feeder to an incandescent-lamp circuit through a certain amount of resistance, said circuit being closed by a substantial knife-blade switch when the semaphore was set in the horizontal position. With single-phase lines or steam railroads this comparatively low-voltage electric current was not available at the line signal and it became necessary to devise some other means for getting the necessary signal light for night use.

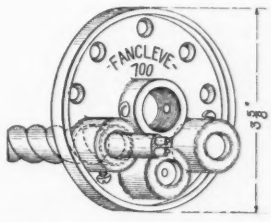
This has been accomplished by supporting a standard four-lens railway switch lamp on a substantial hanger, the shaft of which goes up through the base of the signal. The end of this shaft is so connected with the semaphore shaft that when the semaphore drops to the horizontal position the lamp shaft and lamp are given a quarter turn so that where the lamp shows a white or green light up and down the track when the semaphore is in the vertical or "clear" position it will show a red light up and down the track when the semaphore is set to the horizontal or "stop" position. The weight of the hanger and lamp is supported on a spiral so that not only does the weight of the lamp assist rather than retard the dropping of the semaphore to the horizontal position, but should the rod or pin connecting the lamp shaft with the semaphore shaft be broken the lamp would of its own weight make a quarter turn and show a red light. This is on the side of safety and makes it impossible for the lamp to show anything but red when the semaphore is set at danger. As with all switch lamps, whether fork or socket type, it is impossible for a lamp to be put up showing the wrong light, that is a light at variance with the position of the semaphore.

All of the working parts of this lamp hanger are under the signal cover where they are thoroughly protected against the weather.

It is this type of signal which has been furnished for the Annapolis branch of the Washington, Baltimore & Annapolis Railroad.

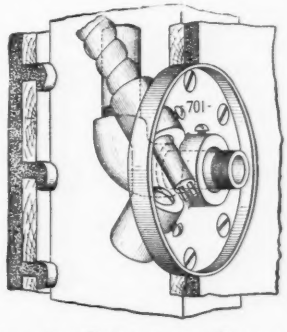
Outlet Plates for Armored Cables for "Fished" Work.

John L. Gleason, Jamaica Plain, Mass., has placed on the market two new outlet plates for armored cables for "fished" work. These plates are designed for old work, and may be used for either "combination" or "straight" electric work. The outside diameter of the plates is three and three-quarter inches, and the outlet may be covered by a four-and-one-half-inch or a five-inch canopy. The plates are three-eighths of an inch deep, so that when the plaster is removed the plates sit against the lathing and are flush with the plaster. On combination outlets the gas nipple passes through the threaded collar or hub of the plate and is grounded thereto by two brass set-screws. The cables are grounded to the plate by the brass set-screws in the cable pockets. These set-screws also confine a suitable plug in the pocket when it is not in use and desired to be sealed. When the outlet is to be used for straight work, a one-half-inch closed nipple is used between the threaded collar and the insulator, or the collar may



OUTLET WITH POCKETS FOR CABLES ENTERING AT NINETY DEGREES.

be bushed down with an ordinary reducer for any smaller size. One plate has three pockets for cables entering the plate at an angle of ninety degrees, and is adapted to sealing outlets, where there is plenty of room between the floor timbers to bend the cables at an easy radius. The other plate is principally intended for wall-outlets, although it may be used in ceilings also. The pockets enter this plate at an angle of about forty degrees, and there is no appreciable bending of the cables when "fished" either up or down partitions. The pockets in this plate also are so disposed as not to conflict with the gas pipe in the partition which is usually fas-



OUTLET WITH POCKETS FOR COMBINATION ENTRANCE.

tened against a stud; and the pockets are of such a length as to permit placing the confining set-screw where it will be sure to make up against the armor rather than the outer braid, as the armor is seldom cut off square in this class of work. The pockets are reamed out forty-one-sixty-fourths of an inch, and all reaming and tapping is done after enameling.

Current Electrical News

DOMESTIC AND EXPORT.

NEW COLORADO POWER COMPANY ORGANIZED—The Fruit Belt Power Company has been incorporated with the secretary of state of Colorado, in Denver, the incorporators being E. A. Sunderlin, Lloyd W. Bassett and Dunbar F. Carpenter, of Colorado Springs, Col. The company is capitalized at $1,500,000, and the directors are: J. A. Hayes, J. Arthur Connell, Horace K. Devereux, E. A. Sunderlin, George B. Tripp, Orson Adams, C. C. Parks and R. D. Ewing. The object of the company is to develop water power for electrical purposes in Mesa County.

MEXICAN ELECTRICAL NOTES—The merger of the Compania de Tranvias de Chihuahua, the Ferrocarril Mineral de Chihuahua and the Planta de Electrica de la Compania Industrial has been concluded at Chihuahua, Mexico. The new company will be one of the largest in that section of the country. Its name will be Compania Electrica y de Ferrocariles de Chihuahua, and it will operate the properties owned by the three old companies. The capital is $2,200,000, and the officers are: President, Enrique C. Creel; Federico Sisniega, vice-president; Martin Falomir, general director, and A. C. Nash, the general manager. On the Fuerte River, in Sinaloa, the Kansas City, Mexico & Orient Railroad plans building a large hydroelectric power plant to develop some 5,000 or 6,000 horse-power, to be used by the Orient Railroad through the most difficult part of the Sierra Madre, going east from Topolobampo Bay. The mines in that region will also be supplied with current. The railroad company has acquired what is known as the O'Gorman concession. A. M. Nelson, engineer and superintendent of construction in Mexico, is making necessary surveys. Up to 10,000 horse-power can, it is believed, be developed if needed.

NEW PUBLICATIONS.

INDEX OF MINING, MECHANICAL AND METALLURGICAL LITERATURE—The North of England Institute of Mining and Mechanical Engineers, Newcastle-upon-Tyne, England, has prepared another volume to its subject matter index of mining, mechanical and metallurgical literature. This is for the year 1902.

MINERAL RESOURCES OF THE UNITED STATES—The United States Geological Survey has issued the annual report of its director, George Otis Smith, dealing with the mineral resources of the United States. This covers the year 1906 and gives a summary of the production during that year and the general conditions obtaining.

ENGINEERING BULLETINS—The University of Wisconsin, Madison, Wis., has issued three bulletins, Nos. 157, 173 and 175, of its Engineering Series. These are respectively: "A Comparison of the Effects of Frequency on the Light of Incandescent and Nernst Lamps," by Frederick William Huels; "Investigation of Centrifugal Pumps," by Clinton Brown Stewart, and "Tests on Plain and Reinforced Concrete, Series of 1906," by Morton Owen Withey.

THE PURCHASE OF COAL UNDER GOVERNMENT SPECIFICATIONS—The Department of the Interior, United States Geological Survey, has published Bulletin No. 339, devoted to "The Purchase of Coal Under Government and Commercial Specifications, on the Basis of Its Heating Value." There is also an analysis of coal delivered under Government contracts. The data have been compiled by D. T. Randall, and the subject is discussed under the following headings: "Advantages of Definite Specifications in the Purchase of Coal," "The Value of Coal as a Fuel," "Specifications in Use," "Methods of Sampling and Testing," "Analyses of Coals Delivered to the Government," and "Some Publications on Coal."

THE SAN FRANCISCO EARTHQUAKE AND FIRE OF APRIL 18, 1906—The United States Geological Survey has published Bulletin No. 324, devoted to "The San Francisco Earthquake and Fire of April 18, 1906, and Their Effects on Structures and Structural Materials." This contains a descriptive preface by Joseph A. Holmes; a chapter by G. K. Gilbert, on "The Earthquake as a Natural Phenomenon"; a chapter by Richard L. Humphrey, on "The Effects of the Earthquake and Fire on Various Structures and Structural Materials"; a chapter by John S. Sewell on "The Effects of the Earthquake and Fire on Buildings, Engineering Structures and Structural Materials," and a chapter by Frank Soulé, on "The Earthquake and Fire and Their Effects on Structural Steel and Steel-Frame Buildings." The text is illustrated by fifty-five plates and several maps.

NEW MANUFACTURING COMPANIES.

EUREKA, CAL.—The Electric Tree Cutter Company has been incorporated with David Cutten as president, and the following directors: B. F. Porter, Jr.; M. H. Newman, M. L. Degnen and Harvey Dale.

CAMDEN, N. J.—The Inter-State Signal Company, of Camden, has been incorporated with a capital of $50,000 to manufacture electric and other railway signals. The directors are: William Daves, W. A. Freese and G. W. Quackenbush, all of Camden.

BOSTON, MASS.—The Invincible Renovator Sales Company has been incorporated to manufacture electrical machines. The capital is $5,000, and the officers are as follows: President, Frank E. Coombs, Boston; treasurer, Thomas Roddin, Cambridge.

ALBANY, N. Y.—The Electrical Music Transmitting Company has been incorporated to manufacture electrical musical devices. The incorporators are: M. Eisner, I. W. Goodhue, of New York city, and J. O. Goldstein, M. L. Blake and A. Heinking, of Brooklyn. The company is capitalized at $50,000.

ROCKFORD, ILL.—The secretary of state has issued articles of incorporation to the Gas and Electrical Device Company of this city. T. W. Pitcher, C. Carson and R. F. Locke are the incorporators of the company, which is capitalized at $100,000. The object of the company is the manufacture of an automatic water heater, gas and electrical specialties.

WARREN, OHIO—The Enterprise Electrical Company, of Warren, has been incorporated with a capitalization of $25,000, and will succeed to the business and good will of the Peerless Transformer Company. The incorporators and officers of the company are as follows: President, R. A. Cobb; vice-president, C. B. McCurdy; secretary, Norval A. Cobb; treasurer, F. P. McBerty, with J. H. Ewalt as the fifth director.

TRENTON, N. J.—The Mercer Electrical Manufacturing Company has filed articles of incorporation with the secretary of state. The authorized capital stock of the company is $25,000, divided into 250 shares at $100 each. The incorporators and the number of shares subscribed for by each are: Theodore G. Kitchen, eight; P. N. Van Fleet, one, and Jonathan Kitchen, one. The concern is to manufacture and deal in electrical machinery, materials and gas-fitting and plumbing devices; also to carry on any trade incident to that business.

DATES AHEAD.

Ohio Independent Telephone Association. Annual meeting, Columbus, Ohio, March 19.

Iowa Electrical Association. Annual meeting, Des Moines, Iowa, April 22-23.

Iowa Street and Interurban Railway Association. Annual meeting, Des Moines, Iowa, April 24.

National Electric Light Association. Annual meeting, Chicago, Ill., May 19-22.

Nebraska Electrical Association. Annual meeting, Omaha, Neb., April 15-16.

ELECTRIC LIGHTING.

ELSINORE, CAL.—Elsinore will vote, on March 23, on a proposition to purchase the electric light plant.

DOYLESTOWN, PA.—The Quakertown borough council will make improvements to the town electric light plant.

PEORIA, ILL.—The electric light plant in Tremont has been sold by Charles H. Gerstner to Henry B. Munson, of Chicago, the consideration being $20,000.

CAMDEN, OHIO—The plant of the Camden Electric Light Company has been sold to Charles S. Houston. Mr. Houston has asked the village council for a franchise to light the municipality.

COLUMBIA, KY.—The Columbia electric light plant has been sold by W. R. Myers & Son, the owners, to Ray Conover. It is said that Mr. Conover intends to enlarge and improve the plant.

LONG PINE, NEB.—The town board has granted a fifty-year franchise to Ira Hewitt, of Neligh, to furnish light and power for the people of Long Pine and vicinity. It is Mr. Hewitt's intention to build a dam on Pine Creek.

NAPOLEONVILLE, LA.—Napoleonville has found that municipal control of the city's lighting plant and market house does not pay and an election will be held March 21 to levy a five-mill six-year tax to maintain the plant.

MORRISTOWN, N. J.—The Morris township committee has granted the Morris & Somerset Electric Company a franchise to erect poles and wires and lay conduit for street lighting on the streets and avenues of the township.

BALTIMORE, MD.—The superintendent of lamps and lighting has instructed the Consolidated Gas, Electric Light and Power Company to install 120 new electric arc lamps, 100 of which are to be erected in the business section of the city.

NEW ALBANY, IND.—Julius Rothrock, who controls the water power in Blue River, at the falls at White Cloud, Harrison County, has obtained a franchise from the commissioners of that county to use the public highways for a lighting and heating system.

HAMPSHIRE, ILL.—The Hampshire village board of trustees has granted a franchise to Louis Koth, of Hampshire, to erect and maintain an electric light plant. Electricity for commercial and public purposes is to be supplied, and plans are now being made for the proposed power-house.

WENATCHEE, WASH.—Gerrick & Gerrick, contractors, will begin work March 1 on a contract with the Great Northern for putting up an electric plant. The electric plant will be used to furnish power to run trains over the mountains from Leavenworth to Skykomish, and will be one of the largest plants in the state.

YOAKUM, TEX.—A movement is on foot in Yoakum to erect another electric light plant. The promoters of the new enterprise are prominent men of the city, and should the project meet with the endorsement of the city council, work on the plant will be pushed.

WARREN, OHIO—The Peerless Electric Company, of Warren, which expects to establish large electric power plants at the two dams in Newton Falls, has been given a perpetual franchise by the village council for commercial lighting in that town, as well as to erect a line of poles on the route to Warren.

COLORADO SPRINGS, COL.—R. W. Chisholm has been elected a member of the board of directors of the Colorado Springs Light and Power Company. Mr. Chisholm succeeds P. B. Stewart. Irving Howbert and Irving W. Bonbright, of Colorado Springs, and George Bullock and S. R. Bertron, of New York, were re-elected.

JOHNSON CITY, TENN.—The plant of the Watauga Electric Company is being remodeled. The line shafting and other old machinery is being removed and a new dynamo is being installed. This new dynamo will furnish power to run the street cars of the Johnson City Traction Company and also to light the city.

SODUS, N. Y.—New electrical machinery has been installed to light the villages of Sodus and Ontario, and the Sodus Gas and Electric Light Company announces that it will soon commence stringing wires from Sodus to Williamson. The company is arranging for its pole line and as soon as the weather moderates the work will be commenced.

IOWA FALLS, IOWA—It is stated that a project is now under way to run a high-tension line from Hampton to Chapin and Geneva and give those towns light and power service from the Hampton plant, while at Union a movement is on foot to build a plant and not only light that town but Whitten and possibly other places within a short radius.

DOVER, ME.—At the annual meeting of the Dover & Foxcroft Light and Heat Company the following-named directors were elected: C. C. Hall, L. P. Evans, Geo. E. Howard, F. E. Guernsey, C. H. Cushing. The directors elected C. C. Hall, president; E. A. Thompson, treasurer; E. W. Crocker, clerk and superintendent. A dividend of four per cent was paid during 1907.

REDDING, CAL.—The Northern California Power Company has been awarded the contract for furnishing the city lights for the ensuing year by the board of trustees. The power company will receive $208.05 per month. The contract calls for thirty-three arc lights on the public streets, a number of alley lights and the lights at the city hall. The new contract comes into existence within sixty days.

WASHINGTON, IND.—The people of Washington have rejected a scheme for remodeling the municipal lighting plant notwithstanding the alternative presented by the common council of providing for extensive repairs or eventually abandoning the business of municipal lighting. An expert who recently examined it decided that it would require $38,000 to put the plant in good running order. The negative vote means that the plant will be sold.

MONROE, WIS.—The common council has adopted a report recommending the installation of a lighting plant in connection with the waterworks, now owned by the city. According to an estimate by the city engineer a saving of $1,000 a year can thus be effected. In case terms can not be made with the local company the matter will be taken to the State Railroad Commission to which the company has surrendered its charter.

BUENA VISTA, GA.—A company has been formed in Jesup with a capital of $300,000 for the purpose of developing water power and generating electricity for manufacturing purposes. The company will erect a cotton mill and a cotton seed oil mill and storage warehouses, and will build and operate an electric railway from Jesup to several other surrounding towns. Application for a charter is now being prepared. The privilege of increasing the capital stock to $500,000 is asked.

CROOKSTON, MINN.—A number of prominent men of the Red River Valley have formed a company which has as its object the erection of a big dam on the Red River near Halstad, Minn., at the junction of the Red River and the Wild Rice River, and if they are allowed to carry out the project it will mean the construction of one of the largest power plants in this section of the country. One of the men interested in the scheme is Elias Steenerson, postmaster of Crookston, and a brother of Congressman Halvor Steenerson. Mr. Steenerson owns land in the vicinity of the proposed dam

NORTHAMPTON, MASS.—The Northampton Electric Lighting Company has sent out circulars announcing a reduction in cost of the service, beginning the first of March. The present price is fifteen cents a kilowatt, and after next month all those using an amount exceeding thirty kilowatts a month will be charged eight cents a kilowatt for the excess. The reduction will mean a net saving of thirty per cent to the average person. One using 100 kilowatts a month pays at the present rates, $15, and under the new schedule the price would be $10.10.

CARTHAGE, MO.—At the annual stockholders' meeting of the Empire Electric Power and Supply Company the following board of directors was elected: J. W. Ground, T. T. Luscomb, T. N. Davey, J. E. Lang and R. J. Claflin. Immediately after the stockholders' meeting, the new board of directors went into session and the following officers were chosen for the ensuing year: T. T. Luscomb, president; T. N. Davey, vice-president; R. J. Claflin, secretary and treasurer. It was decided to make a number of extensive improvements to the plant and these will be begun in

the very near future. A new 100-horse-power engine will be installed.

SHARPSBURG, MD.—The council has awarded a contract for electric lighting to John W. Livers.

COLLINS, MISS.—The city council has ordered the issuance of $4,000 bonds to improve the water and light plants.

LOCKPORT, N. Y.—The common council has awarded the contract for the furnishing of power for the new waterworks station at Tonawanda to the Tonawanda Light and Power Company.

SPARTANBURG, S. C.—Oscar Shanks, manager of the Electric Manufacturing and Power Company, says that within ninety days the company will be ready to furnish power in the city. The work at the power-house has been practically finished. The substation to be built at Spartanburg will cost between $15,000 and $20,000.

BUFFALO, N. Y.—The Buffalo General Electric Company has taken title to the New Gruener Hotel property at the corner of Washington, Huron and Genesee streets. The purchase price involved is between $90,000 and $95,000. The Cataract Power and Conduit Company has taken a lease upon a part of the property for a term of years, and will occupy it jointly with the Buffalo General Electric Company.

TRINIDAD, COL.—J. J. Henry, of Denver, the promoter representing the Southern Colorado Power Company, who recently purchased for his company the plant and lines of the Trinidad Electric Light and Power Company, has returned from New York city and announces that the new corporation has been financed. According to Mr. Henry the new company now has a deal on with Senator Clark, of Montana, who has an option on several thousand acres of coal land in the Stonewall Mountains, to furnish light and power for the Clark mines when they are opened. The new company also proposes to electrify several tracts in this vicinity and to furnish light and power for several corporations in southern Colorado.

PRINEVILLE, ORE.—H. V. Gates, of Hillsboro, president of the Prineville Light and Water Company and several other lighting plants throughout the state, has announced that construction of a large power plant at Lava Falls, on the Deschutes, six miles south of Bend, will begin in the early spring. The plant is to be completed within a year. It is to cost $150,000 and will give the towns of Bend, Laidlaw, Redmond and Prineville a twenty-four-hour service for lighting and other purposes. The company expects to secure 2,000 horse-power at Lava Falls. Negotiations between Mr. Gates and F. S. Stanley, of the Deschutes Irrigation and Power Company, which has filed on the water right there, are now under way. The company has agreed to transfer to Mr. Gates all the water necessary for the project.

SHEBOYGAN FALLS, WIS.—The president and trustees of the village of Sheboygan Falls have advertised for the submission of written bids or proposals for the franchise to be granted for the term of twenty-five years, commencing March 8, 1908, for the use of the streets, lanes and alleys of said village, in the establishment, maintenance and operation of an electric light plant and system, according to the specifications containing the rules and regulations for the maintenance and operation of such plant and the conduct of the same on file in the office of the village clerk. Bids or proposals should state what percentage of the gross receipts from the operation of such plant the bidder will pay annually into the treasury of the village in consideration of receiving a franchise. All bids are to be filed with the village clerk on or before 7.30 o'clock P. M., March 16.

HARTFORD, CT.—At the annual meeting of the stockholders of the Hartford Electric Light Company the old by-laws were repealed and new ones adopted. The following directors were elected for the coming year: A. C. Dunham, S. G. Dunham, D. N. Barney, E. K. Root, W. F. Henney, Henry Roberts, M. G. Bulkeley, Ralph W. Cutler, Atwood Collins, W. O. Burr, George G. Williams, Louis R. Cheney. George H. Gilman was elected auditor. A directors' meeting was held immediately afterwards and the following officers were re-elected: President, A. C. Dunham; vice-president, S. G. Dunham; treasurer, D. N. Barney; secretary and assistant treasurer, Curtis C. Cook; executive committee, the above officers and Dr. E. K. Root and Senator Morgan G. Bulkeley. The office of assistant treasurer, to which Secretary Cook has been elected, is a new office.

NEW INCORPORATIONS.

AUGUSTA, ME.—Union Independent Telephone Company, Augusta. $200,000. President and treasurer, J. Berry, Augusta.

COLUMBUS, OHIO—Lake Superior Railway Construction Company, Cleveland. Increase of capital from $10,000 to $15,000.

DOVER, DEL.—Cuban Telephone Company. $500,000. Incorporators: W. Lohman, D. C. Beerman, W. T. Patterson, New York city.

AUSTIN, TEX.—The Falfurrias Telephone Company, of Falfurrias, Starr County. Increase in capital stock from $5,000 to $7,500.

AUGUSTA, ME.—Hancock & Lake Linden Traction and Power Company, Portland. $800,000. President, J. E. Manter; treasurer, C. E. Eaton, Portland.

ALBANY, N. Y.—Susquehanna River Power Company, Hartwick, Otsego County. $200,000. Incorporators: C. A. Greene, J. Myers, T. Achenbach, New York city.

SPRINGFIELD, ILL.—Illinois Heating, Light and Power Company. To operate light, heat and power plants. $25,000. Incorporators: J. D. Robertson, A. Snedden, N. Baxter, Sr., Canton.

LEETONIA, OHIO—People's Electric Light and Power Company, of Leetonia. $15,000. Incorporators: Albert E. Green, Allison J. Thompson, John W. Garfield, E. J. Blandin and Frank H. Cinn.

BOSTON, MASS.—Colrain Electric Light and Power Company, Colrain. $25,000. President, John W. Cram; treasurer, Henry A. Smith. Directors: Fred W. Pennington, John C. Thomson, Reuben C. Hillman.

HARRISBURG, PA.—Farmers' Independent Telephone and Telegraph Company, of Rintown; to operate in Columbia and Schuylkill counties; $5,000. Fairview Telephone Company, of Fairview, Erie County; $10,000.

BOSTON, MASS.—Connecticut River Transmission Company. $10,000. Formed for the purpose of manufacturing and transmitting electricity for heat and power. Officers: C. Arthur Fiske, president; William W. Brooks, treasurer.

TRENTON, N. J.—American Light, Heat and Power Company, Westfield. To transmit and distribute electric current for light, heat and power. $250,000. Incorporators: G. L. Delatour, Westfield; G. R. Lepart, A. Worshaw, New York city.

MEMPHIS, TENN.—Paris-Subiaco Traction Company. $60,000. Incorporators: D. J. Young, Conrad Elsken, G. G. Dandridge, Henry Stroup and Charles J. Jewett. The company proposes to build a line five miles in length from Paris to a point at or near Subiaco, in Logan County.

OLYMPIA, WASH.—Yakima Inter-Valley Electric Railway Company. To build a line from the Northern Pacific, near Granger, through Zillah and Parker bottom to Parker siding and North Yakima. $1,000,000. Incorporators: H. H. Lombard, A. B. Wilcox, J. H. Thomas, C. H. Furman, George P. Eaton and T. G. Page.

SPRINGFIELD, ILL.—Mississippi Valley Interurban Railway Company, Springfield. $1,000,000. To construct an electric line from Springfield to Petersburg, Virginia, Rushville, Quincy, Mt. Sterling, Pittsfield, Hardin, Jerseyville, Winchester, Jacksonville and Hillsboro, and from Hillsboro to Greenville and Shelbyville, *via* Owaneco and Vandalia, and from Greenville to Carlyle, Nashville, Pinckneyville and Murphysboro.

AUSTIN, TEX.—Texas Union Traction Company, of Clarksville, Red River County. $2,000. Organized for the construction of an electric railway for the transportation of passengers as follows: Between the cities of Texarkana and Sherman, a distance of 154 miles; between the cities of Paris and Ennis, a distance of 124 miles; between the cities of Texarkana and Fort Worth, a distance of 215 miles; between the cities of Paris and Cleburne, a distance of 155 miles, and for extensions and spurs leading out from points on the main line to inland towns, estimated distance from five to twenty miles from the main line. Incorporators and directors; C. P. Moore and John T. Upchurch, of Longfellow, Pecos County, and A. A. St. John, of El Paso.

PERSONAL MENTION.

MR. GEORGE A. McKINLOCK, president of the Central Electric Company, Chicago, Ill., is enjoying a three months' sojourn in southern Europe.

DR. E. B. ROSA, physicist, of the Bureau of Standards, has sailed for Europe, where he will spend three or four months in a study of methods for harmonizing standards of light in the gas and electric industries.

MR. ROBERT McF. DOBLE, consulting and supervising engineer, making a specialty of hydroelectric power and transmission, formerly of San Francisco, Cal., announces the removal of his office from Colorado Springs, Col., to 528 Majestic Building, Denver, Col.

MR. GEORGE P. HUTCHINS will move to 11 West Thirty-second street, New York city, where he will be associated with the Homer W. Hedge Company, general advertising agents, managing the technical department of their business. This arrangement will not affect Mr. Hutchins's personal clientele.

MR. ALPHONS WESTEE has been elected treasurer of the Thomas A. Edison companies to succeed John F. Randolph. Mr. Westee was born in Brooklyn in 1865 and entered into Mr. Edison's employ as an office boy when he was seventeen years of old. He has been auditor of the companies for fourteen years.

MR. A. E. PARK has resigned his position as general manager of the Des Moines, Winterset & Creston interurban project. E. B. Steere has been elected to succeed him. Mr. Steere has been vice-president of the company for over a year. Mr. Park has gone to Chicago where, it is understood, he will take up similar lines of work.

MR. S. W. HUFF, general manager of the Virginia Passenger and Power Company, Richmond, Va., will, on March 1, assume the position of president of the Coney Island & Brooklyn Railroad, Brooklyn, N. Y. Mr. Huff has been with the Virginia company for about six years, during which time he has practically rehabilitated the system.

MR. E. P. DILLON, it is announced, will assume the management of the Colorado Springs Electric Company, Colorado Springs, Col., taking the place of R. P. Bache, resigned. Mr. Dillon is at present manager of the Pikes Peak Hydroelectric Company, and will retain this position, managing both companies. The output of the Pikes Peak company is purchased by the Colorado Springs company.

MR. E. C. DEAL, who has been in charge of the Bergen County division of the Public Service Corporation of New Jersey for several years, has been transferred to Elizabeth to take charge of that office. He will have general supervision of the central division, which comprises all of Union, Middlesex and Somerset counties. This division had previously been in charge of several division superintendents. H. P. Chandler has been made the general agent of commercial business, with headquarters at Elizabeth. He has been for a number of years in charge of the electric plant, headquarters division, Newark.

MR. WILLIAM P. BEAR, now with Kohler Brothers, of Chicago, will remove to Duluth about March 1, to assume managerial duties with the Northern Electrical Company, of Duluth and Minneapolis. Mr. Bear will be the general manager of the Duluth house. He has been in the electrical business since boyhood, serving in various capacities with W. T. Osborne & Company, of Kansas City; Chicago Edison Company, Illinois Steel Company, Fort Wayne Electric Works, and in his last position with Kohler Brothers. Mr. Bear is a graduate of Armour Institute, having worked his way through that institution and having been honored by its faculty with one of two scholarships in recognition of high standing in all his work. With Kohler Brothers, where he has been for the past three years, he has had full control of all switchboard work for the firm, doing the engineering and directing all switchboard installations, as well as handling the commercial end of the switchboard department. He leaves behind him in Chicago a host of friends who wish him success in his new field. Mr. Frank McMasters, for many years with the Fort Wayne Electric Works, and well known in the electrical field, also recently associated himself with the Northern Electrical Company.

TELEPHONE AND TELEGRAPH.

OMAHA, NEB.—The Independent Telephone Company has secured funds to the amount of $325,000 for the immediate extension of its lines.

LINCOLN, NEB.—At the annual meeting of the Seward County Telephone Company the officers were re-elected and a ten per cent dividend declared.

FERGUS FALLS, VT.—The farmers of the town of Maplewood have organized a telephone company and will construct a local system there and in adjoining towns, with connections with an outside line at Erhard. The officers of the new company are: President, A. G. Eddy; secretary, B. G. Emery; treasurer, Harrison Worden. Directors are: Ole Nodsle, Ivar Anderson and C. W. West.

BELOIT, WIS.—The Beloit Home Telephone Company, at its annual meeting, elected the following officers for the ensuing year: President, M. J. Ward; vice-president, Alonzo Burt; treasurer, W. M. Brittan; secretary, M. J. Carney; general manager, Alfred Slater. The officers and the following constitute the board of directors: W. H. Grinnel, W. D. Hall, Joshua Foster, C. B. Salmon and H. D. Seymour.

ELECTRICAL SECURITIES.

The market indicated little evidence of change in sentiment from that exhibited during the past few weeks. There were few declines, however, as the market is more or less sold out. The absence of many active members of the exchange on winter vacations and the determination of others to give the market a rest have made for a dull season, which will probably last for some little while.

Dividends have been declared upon the following electrical securities: Chicago City Railway Company; quarterly dividend of 1½ per cent, payable March 30 to stock of record March 9. Books close March 10 and reopen March 14.

ELECTRICAL SECURITIES FOR THE WEEK ENDED FEBRUARY 22.

New York:	*Closing.*
Allis-Chalmers common	5¾
Allis-Chalmers preferred	17
Brooklyn Rapid Transit	40½
Consolidated Gas	101
General Electric	115
Interborough-Metropolitan common	6¾
Interborough-Metropolitan preferred	17¾
Kings County Electric	90
Mackay Companies (Postal Telegraph and Cables) common	53
Mackay Companies (Postal Telegraph and Cables) preferred	60
Manhattan Elevated	121
Metropolitan Street Railway	15
New York & New Jersey Telephone	98
Western Union	46¼
Westinghouse Manufacturing Company	39

Boston:	*Closing.*
American Telephone and Telegraph	106¼
Edison Electric Illuminating	204
Massachusetts Electric	42
New England Telephone	107½
Western Telephone and Telegraph preferred	50

The New England Telephone Company has issued the official notice to stockholders of their right to subscribe, until April 17 next, to $3,962,200 of the new stock in the ratio of one share of new for each eight shares of old stock.

Philadelphia:	*Closing.*
Electric Company of America	8¾
Electric Storage Battery common	27
Electric Storage Battery preferred	27
Philadelphia Electric	5⅝
Philadelphia Rapid Transit	15¼
United Gas Improvement	76½

At a meeting of the directors of the United Gas Improvement Company the resignation of W. W. Gibbs as a member of that body was presented and accepted and Rudolph Ellis elected to succeed him. Mr. Gibbs was one of the earliest directors of the company.

Chicago:	*Closing.*
Chicago Telephone	109½
Commonwealth Edison	85
Metropolitan Elevated preferred	45
National Carbon common	53½
National Carbon preferred	103

ELECTRIC RAILWAYS.

PERRY, N. Y.—The village board has granted a franchise to the backers of the proposed electric railroad from Rochester to Perry, Silver Creek and Portage.

GRAFTON, W. VA.—At an early date the Fairmont & Clarksburg Traction Company will begin work on extending its line from Grasselli to Bridgeport.

EVANSVILLE, IND.—Local capitalists are interested in building a traction line from Vincennes, Ind., to Casey, Ill., to tap the Illinois oil fields. A survey will be made at once.

NORTH YAKIMA, WASH.—The promoters of the Granger-Zillah-Parker Transportation Company have decided to incorporate and construct their own electric railway line.

BOSTON, MASS.—The railroad commission has authorized the issuance by the Northampton Street Railway Company of $175,000 worth of capital stock at 110 to pay for its floating debt.

JANESVILLE, WIS.—H. H. Zigler, of Columbus, Ohio, who last fall promised that his company would build an electric line from Janesville to Madison, states that it will build the line this year.

MOBILE, ALA.—C. A. Elkin, who is promoting an electric street railway from Mobile to Citronelle, has obtained a franchise from the town of Citronelle to construct a roadbed and lay tracks in the principal streets of that city.

OGDEN, UTAH—To increase the power of the local plant of the Utah Light and Railway Company, the concern wishes to raise the cañon dam sufficiently to hold a greater amount of storage water. The addition to the dam will be of concrete and will cost in the neighborhood of $10,000.

ALLENTOWN, PA.—The Eastern Pennsylvania Railways Company has completed the new eight-mile trolley link between Middleport and Tamaqua. With this connecting link trolley cars will now be run from Pottsville to Mauch Chunk, through the most populous part of the anthracite regions.

YORK, PA.—At a meeting of farmers and other residents of Loganville, Shrewsbury, Glen Rock, Seven Valley and Paradise a company was organized to construct a trolley line from Shrewsbury to this city. They are isolated from markets that can be reached by trolley or railroad.

WINCHESTER, KY.—The Central Kentucky Traction Company, which now owns the Winchester city railway, will take charge of the operation of the road on March 1. The former owner, the Winchester Railway, Light and Ice Company, will continue to furnish the electric power for the operation of the line.

ANNAPOLIS, MD.—A bill granting a charter for the building of an electric road from Reisterstown to Hanover has been offered in the House by Mr. Frederick, of Carroll County. The proposed road is to connect with the Hanover & York electric road at Hanover and with the United Electric Railways at Reisterstown.

MINNEAPOLIS, MINN.—During the year 1908 the Minneapolis Rapid Transit Company proposes to extend its lines throughout Minneapolis streets on a larger scale than for many years, the total amount of new track to be laid aggregating several miles. Notice of the proposed extension has been filed with the city clerk.

HUNTSVILLE, ALA.—T. W. Pratt, director of the Nashville & Huntsville Railway, has informed the railway committee here that his company has begun arrangements to secure right of way from Huntsville to Birmingham, the purpose of the company being to build south of here as soon as the Nashville & Huntsville line is finished.

FARGO, N. D.—Traffic arrangements, both passenger and freight, have been made with the Minneapolis, St. Paul & Sault Ste. Marie Railroad by the officials of the Northwestern Interurban Railway Company, of this city, whereby the electric line will carry all "Soo" business to Fargo over the electric line from the junction point near Detroit, Minn., to this city.

GREELEY, COL.—The county commissioners have granted E. M. Reaser, of Denver, an extension from February 10 to April 1 on his franchise for an electric railway between this place and Denver. All rights of way have been secured, but more time is needed for filing maps. Nearly $23,000 has been spent for rights of way and surveys and Reaser says he has ample financial backing and will begin construction April 1.

MARQUETTE, MICH.—At the regular monthly meeting of the Houghton council J. T. Healy made application for a franchise for the proposed South Range Street Railway Company. The plan is to construct a trolley line from Houghton to the village of South Range. It is understood that C. C. Douglass, C. H. Hanchette and Mr. Healy are among the prime movers.

PITTSBURG, PA.—Thomas Fitzgerald, who recently resigned as general manager of the Baltimore & Ohio, is said to be at the head of a new company being organized to build an electric line between Clarksburg, W. Va., and Pittsburg. It is proposed to begin actual construction work early in the spring. Engineers are said to be now in the field. Should the line be built it will also be equipped for handling freight traffic.

NEW YORK, N. Y.—Plans have been filed with the Bureau of Buildings in the Bronx for four stations to be erected by the Harlem River & Port Chester Railroad, the six-track suburban electric system of the New Haven road, which has been under construction for the last few years. Two of the stations will cost $50,000 each and the other two $45,000 each. They will be of brick construction and one-story. Cass Gilbert is the architect.

McALESTER, OKLA.—The Choctaw Railway and Lighting Company, in which Colonel William Busby recently purchased a controlling interest, has been reorganized by the election of the following board of directors: William Busby, A. U. Thomas, E. S. Million, M. E. Williams, C. W. Dawley, W. J. Wade and L. C. Rose. These are all local capitalists, with the exception of Mr. Rose, who is president of the Colonial Trust Company, of Chicago. Colonel Busby was elected president, M. E. Williams secretary, and E. D. Bevitt treasurer.

NASHVILLE, TENN.—There was no change either in officials or board of directors of the Nashville Railway and Light Company at the annual meeting of its stockholders and directors. Over $3,500,000 of stock was represented by the stockholders present and, after the hearing of reports from the various officers, the stockholders proceeded with the election of a board of directors, which resulted in the re-election of the old members. Immediately after the adjournment of the stockholders' meeting the board of directors met and re-elected the old officials.

LITTLE FALLS, N. Y.—At a meeting in this city of Johnstown and Little Falls citizens, it was decided to go ahead and build a railroad from this city to Johnstown, which will complete the gap in the cross-state trolley system. After a discussion of the question the following committee was appointed to organize the company, purchase right of way and make the preliminary surveys: Eugene Walrath, D. H. Burrell, Timothy Dasey, Mayor A. B. Santry and Irving Snell, of Little Falls; Frederick Englehardt, of St. Johnsville; Mayor Beebe, Fred L. Carroll, E. M. Kennedy, William Decker, John Potter and C. I. Combes, of Johnstown.

SEATTLE, WASH.—The Seattle Electric Company will spend $1,500,000 for line improvements, extensions and equipment in Seattle this year. Aside from additional equipment it has been found necessary to double track many of the lines. Several districts where growth has been rapid outgrew the single track last year. A large part of the appropriation for improvements in the Seattle system will be expended for laying second tracks on existing lines. At Georgetown it is planned to enlarge the power plant and the shops. Preparations will also be made for the exposition, which will necessitate a great deal of additional line building.

DES MOINES, IOWA—Provisions for a much improved and speedier service were made at the annual meeting of the Des Moines City Railway Company and nearly $150,000 will be expended in this work this year. An appropriation of $125,000 was made to defray the expense of erecting a power plant that will be a duplicate of the present one. The present plant has a capacity of 3,250 horse-power and this will be doubled with the completion of the power-house. The following officers and directors were elected: President, George M. Hippee; vice-president, Harry H. Polk; secretary, N. T. Guernsey; treasurer, G. B. Hippee; general manager, A. G. Maish. Directors: N. W. Harris, A. W. Harris, E. B. Smith, N. T. Guernsey, G. M. Hippee, H. H. Polk and George B. Hippee. Mr. Hippee succeeds the late J. S. Polk as president and Mr. Maish succeeds Mr. Hippee as general manager.

INDUSTRIAL ITEMS.

THE STUART-HOWLAND COMPANY, Boston, Mass., has ready for distribution its discount sheet No. 2, dated February 1, 1908, applying to catalogue No. 3.

THE CENTRAL ELECTRIC COMPANY, 264-270 Fifth avenue, Chicago, Ill., has issued a bulletin devoted to insulating compounds and mineral rubber paints. This bulletin will be sent to those interested upon request.

THE DUNCAN ELECTRIC MANUFACTURING COMPANY, Lafayette, Ind., is distributing an attractive calendar advertising its alternating-current and direct-current wattmeters, lightning arresters, and ammeters and voltmeters.

THE PARK DROP FORGE COMPANY, Cleveland, Ohio, has published an attractive bulletin entitled "Short Stories About Steel." These are devoted, respectively, to the early history of iron-making in England, the kind of steel used in modern drop forgings, and common elements found in steel.

THE HELIOS MANUFACTURING COMPANY, Bridesburg, Philadelphia, Pa., announced that at the annual meeting of the company, held on February 8, the following directors were elected: King Upton and Thomas Courtis, Marblehead, Mass.; A. P. Swoyer, Charles Delaney and G. H. Rettew, Philadelphia, Pa.

THE BENJAMIN ELECTRIC MANUFACTURING COMPANY, Chicago, Ill., announces that its No. 903 attachment plug has been approved by the Underwriters' Laboratory. The device has met with such favor from the trade that the company has not been able to fill all of the advance orders which have been received.

THE ENGINEERING SPECIALTY COMPANY, 143 Liberty street, New York city, will be pleased to send Bulletin No. 106, devoted to direct-current motors, dynamos, motor-generators and dynamotors, to interested parties upon request. The company has also issued some attractive literature devoted to the "Stamford" electric clock and programme system for schools, factories, public buildings, hotels, etc.

THE RAILWAY SPECIALTY AND SUPPLY COMPANY, Chicago, Ill., agent for the Pittsburg Lamp, Brass and Glass Company, states that the bulk of the signal glass lenses and roundels in the yards of the new Washington (D. C.) terminal is Kopp signal glass. The photometric limits were selected after a series of joint conferences and tests by the signal officials of the Pennsylvania Railroad and the Baltimore & Ohio Railroad.

THE JEFFREY MANUFACTURING COMPANY, Columbus, Ohio, has issued a handsome catalogue devoted to rubber-belt conveying machinery. The company also makes chain elevating and conveying machinery, screening, crushing and mining machinery, pulverizers, tipples, coal and rock drills, electric locomotives for mines and industrial plants, etc. The illustrations in the booklet above mentioned show the application of rubber-belt conveyers for handling materials of various kinds.

THE INTERNATIONAL STEAM PUMP COMPANY, New York city, announces the removal of its general offices to 115 Broadway. The company also announces that the repair shops of Henry R. Worthington, the George F. Blake Manufacturing Company, Knowles Steam Pump Company, the Laidlaw-Dunn-Gordon Company, the Clayton Air Compressor Works, the Snow Steam Pump Works, Holly Manufacturing Company, and the Deane Steam Pump Company will be located at 44 Trinity Place.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., is furnishing the entire electrical equipment for the Tajo mines in the Rossario district of Mexico. The order includes a three-phase, sixty-cycle, 2,300-volt, revolving-field generator of 150 kilowatts' capacity; nine oil-cooled, type H transformers; three 440-volt, form K induction motors of fifteen, thirty-five and seventy-five horsepower capacity, with starting compensators; two-circuit feeder panel; complete lightning arrester equipment, and the necessary supplies of wire, insulators, etc.

THE FREDERICK PEARCE COMPANY, 18-20 Rose street, New York city, has issued catalogue No. 601, devoted to X-ray and high-frequency apparatus, accessories and supplies. A complete exhibit of the company's apparatus has been set up in a special room, where all those interested in these devices will be welcomed and where each piece of apparatus may be tested under actual working conditions. Among the apparatus described are Willyoung induction coils and interrupters, coils for wireless telegraphy, regulating interrupters and rheostats, self-regulating tubes and the Caldwell tube and radiographic stand.

Record of Electrical Patents.

Week of February 18.

879,138. RAILWAY SIGNALING DEVICE. Frederick Bauer, New York, N. Y. The signal is controlled by a single switch operated by the cars.

879,158. TRANSFORMER. Charles Le G. Fortescue, Wilkinsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. A transformer with subdivided coil and means for changing the point of connection.

879,168. ELECTRIC RAILWAY SIGNAL. Frederic M. Hill and William C. Davis, Columbus, Ohio. An electrically released signal controlled by the cars.

879,180. ARC LAMP. Oskar Könitzer, Munich, Germany. A carbon eccentrically perforated for regulating the rate of feed.

879,234. ELECTRIC CIRCUIT CONTROLLER. Christian Aalborg, Wilkinsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Two groups of contact closers operated alternately.

879,245. CONTACT FINGER. William Cooper, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. The contact finger is mounted on a spring having a limited movement.

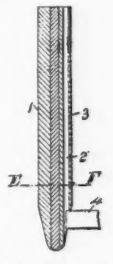
879,246. COMMUTATOR FOR ELECTRIC APPARATUS. Frederick W. Cox, Wilkinsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. A commutator bar supported centrally and at the ends.

879,252. MULTIPLE-RATIO TRANSFORMER. Charles Le G. Fortescue, Wilkinsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. The primary and secondary coils are subdivided and interpolated with one another.

879,285. AUTOMATIC MULTIPLE FUSE BLOCK. William C. Mayo and John Houlehan, El Paso, Tex., assignors of one-third to George E. Briggs, Barstow, Tex. A circuit shunted around the fuse block controls the restoring device.

879,300. TELEGRAPH SWITCHBOARD. Albert T. Newman, Greeley, Kans. The circuit terminals are circularly disposed, contacts being made by a rotatable switch.

879,307. SYSTEM OF ELECTRICAL DISTRIBUTION. Roderick M. Palmer, Cambridge, Mass., assignor to Palmer Electrical Company, Bangor, Me. The potential of the system is subdivided by means of resistances.



879,180.—ARC LAMP.

879,357. TELEGRAPHIC TRANSMITTER. Clarence Brain, Parsons, Kan. The different signals are made by means of a series of spaced contact brushes.

879,361. BATTERY PLATE. William M. Brodie, West Orange, N. J., assignor to Edison Manufacturing Company, West Orange, N. J. A pressed, corrugated copper oxide plate.

879,385. ELECTRICAL MEASURING INSTRUMENT. Adrian H. Hoyt, Penacook, N. H., assignor to Whitney Electrical Instrument Company. A permanent magnet instrument with damping device.

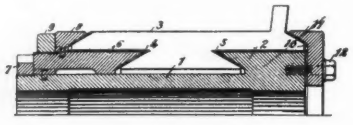
879,397. AIR-BRAKE, LIGHTING AND SIGNALING SYSTEM FOR RAILWAY TRAINS. William C. Mayo and John Houlehan, El Paso, Tex., assignors of one-third to George Edwin Briggs, Barstow, Tex. The air-compressor is geared to the running wheels of the car, the brakes being controlled electrically from the locomotive.

879,409. WIRELESS TELEGRAPHY. George W. Pierce, Cambridge, Mass., assignor to Massachusetts Wireless Equipment Company. Connections are provided for placing the detector either in the primary or secondary of the inductive connection.

879,410. ELECTRIC SIGNALING CLOCK. Henry S. Prentiss, Elizabeth, N. J. A time-signaling clock with flexible contact fingers.

879,411. SELF-WINDING CLOCK. Henry S. Prentiss, Elizabeth, N. J. A spring-driven, electrically wound clock.

879,425. ELECTRIC GENERATOR FOR TELEPHONE LINES. Henry Tideman, Menominee, Mich. A magneto generator.



879,246.—COMMUTATOR FOR ELECTRIC APPARATUS.

879,438. TELEPHONY. Morgan Brooks, Urbana, Ill. An induction coil with a third winding places the receiver in inductive relation with the line but in non-inductive relation with the local transmitter.

879,454. TELEPHONE-EXCHANGE APPARATUS. William A. Fricke, Chicago, Ill., assignor to Monarch Telephone Manufacturing Company, Chicago, Ill. Means are provided at the central station for introducing condensers in the talking sides of united telephone lines.

879,494. TRAIN PROTECTION FOR RAILWAYS. Benton C. Rowell, Chicago, Ill., assignor to Rowell Potter Safety Stop Company, Portland, Me. A block system.

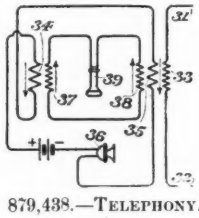
879,498. ELECTRICAL WATER HEATER. Milton H. Shoenberg, San Francisco, Cal. Bare electrical conductors, not connected together, are placed in the heating chamber.

879,532. SPACE TELEGRAPHY. Lee de Forest, New York, N. Y., assignor, by mesne assignments, to de Forest Radio-Telephone Company. A system employing an exhausted vessel as a detector.

879,564. TURBO-ALTERNATOR. Charles E. Lord, Norwood, Ohio, assignor to the Bullock Electric Manufacturing Company. Special means are provided for circulating cooling air through the generator.

879,593. TROLLEY WHEEL. Jacob M. Siegrist, Oswego, N. Y. A self-restoring trolley wheel with spiral groove.

879,636. TROLLEY WHEEL. Edward J. Harrison, South Bend, Ind. Lubricant is applied to the running groove of the wheel through hollow spokes.



879,438.—TELEPHONY.

879,643. TELEPHONE CIRCUIT. Charles M. Jacobs, Reading, and William J. Thorrowgood, Wimbledon Park, England. A transformer is placed in the telephone circuit to eliminate external influences.

879,648. MEANS FOR AUTOMATICALLY CLOSING ELECTRIC CIRCUITS. Fayette W. Keeler, Temple, Tex., assignor of one-half to W. Morants, Temple, Tex. An alarm system controlled by a clock movement.

879,650. ELECTRIC TRANSMISSION OF INTELLIGENCE. Isidor Kitsee, Philadelphia, Pa., assignor of one-half to William J. Latta, Philadelphia, Pa. Impedance coils distributed along the line serve to prevent disturbing effects of neighboring conductors.

879,651. ELECTRIC TRANSMISSION OF INTELLIGENCE. Isidor Kitsee, Philadelphia, Pa. Leakage circuits are provided between the telephone and the neighboring power circuit to eliminate disturbing influences of the latter.

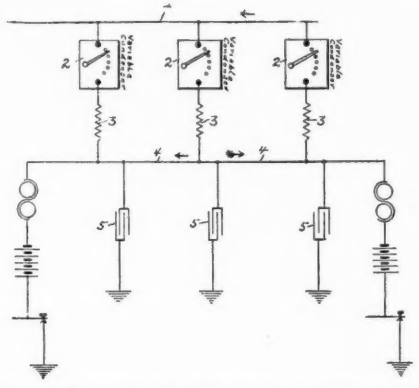
879,683. PROTECTOR FOR THIRD RAILS. Frank D. Sharp, Altoona, Pa. A protector for inverted third rails.

879,697. ELECTRIC CLOCK WINDING MECHANISM. Adolf Trilke, Eimsbüttel, near Hamburg, Germany. An electrically wound, weight-driven clock.

879,699. ELECTRIC PUMP-GOVERNOR. Walter V. Turner, Wilkinsburg, Pa., assignor to the Westinghouse Air Brake Company, Pittsburg, Pa. The pump is cut in by a low-tension regulating means, and cut out by a high-tension regulating device.

879,711. TELEGRAPHIC TRANSMITTER. Clyde Williams, Porter B. Mitchell and Sharpe Hathaway, Barton, Ohio. A telegraph transmitter consisting of an electromagnet with a movable armature and horizontally moving keys.

879,723. ATTACHMENT PLUG. Reuben B. Benjamin, Chicago, Ill., assignor to Benjamin Electric Manufacturing Company, Chicago, Ill. A movable lamp contact is carried on the base.



879,651.—ELECTRIC TRANSMISSION OF INTELLIGENCE.

879,724. ELECTRIC-LAMP SOCKET. Reuben B. Benjamin, Chicago, Ill., assignor to Benjamin Electric Manufacturing Company, Chicago, Ill. A pendant socket.

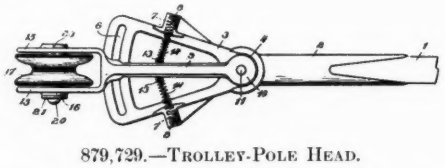
879,725. ATTACHMENT PLUG. Reuben B. Benjamin, Chicago, Ill., assignor to Benjamin Electric Manufacturing Company, Chicago, Ill. A plurality of contact strips secured to the base.

879,729. TROLLEY-POLE HEAD. George G. Buchanan, Dubois, Pa. The wheel is pivoted to provide lateral motion.

879,760. SWITCH PLUG. Henry C. Froelich, Chicago, Ill., assignor to Benjamin Electric Manufacturing Company, Chicago, Ill. A plug composed of a body with a longitudinally moving post.

879,765. SUPPORT FOR ELECTRIC SERVICE WIRES AND CABLES. Edward H. Greenleaf and Theodore A. Dissel, Newburgh, N. Y. A wire support which is sprung around the cables.

879,773. EXTENSION PLUG FOR ELECTRIC LIGHTS. Bryson D. Horton, Detroit, Mich., assignor to Benjamin Electric Manufacturing Company, Chicago, Ill. A socket with a reciprocatory coned pin.



879,729.—TROLLEY-POLE HEAD.

879,789. REGULATING MAGNET-CONTROLLER FOR ELECTRIC ELEVATORS. Henry P. McColl, Hawthorn, Victoria, Australia. The controlling rheostat is actuated by solenoids having windings with opposite influences.

879,814. ELECTRICAL TYPEWRITER. George W. Donning, East Orange, N. J., assignor to Harry T. Ambrose, Orange, N. J. Electrical connection is provided between the keyboard and the longitudinally traveling type carriage.

879,819. ELECTRIC-LAMP SOCKET. Gilbert W. Goodridge, Bridgeport, Ct., assignor to the Bryant Electric Company, Bridgeport, Ct. A two-part socket.

879,828. ELECTROPNEUMATIC DRILL. Olin S. Proctor, Denver, Col. The combination of a reciprocating pneumatic drill with an electrically driven compressor.

879,830. ATTACHMENT PLUG. David L. Webb, New York, N. Y., assignor, by direct and mesne assignments, to Benjamin Electric Manufacturing Company, Chicago, Ill. An attachment plug with spring fingers.